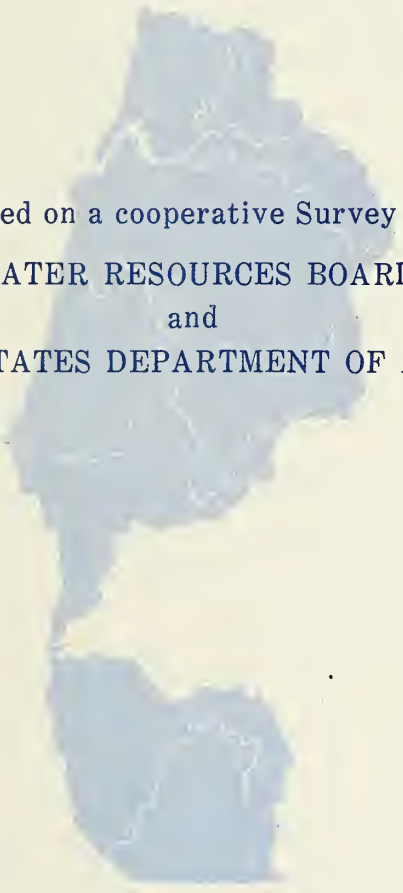
P.N. Beattie

USDA Report on
WATER and RELATED LAND RESOURCES

SOUTH COAST DRAINAGE BASIN
OREGON



Based on a cooperative Survey by

THE STATE WATER RESOURCES BOARD OF OREGON

and

THE UNITED STATES DEPARTMENT OF AGRICULTURE

Prepared by · · ECONOMIC RESEARCH SERVICE · · FOREST SERVICE · ·
SOIL CONSERVATION SERVICE

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INTRODUCTION

This report presents information concerning the water and related land resources of the South Coast Drainage Basin and is the result of a cooperative study by the U. S. Department of Agriculture and the State Water Resources Board of Oregon.

The State Water Resources Board of Oregon is making a survey and investigation of the South Coast Drainage Basin to develop information needed for planning the coordinated development of the area's water resources. The information needed for its study includes: (1) the kind and location of desirable water resource developments; (2) the amounts of water required; (3) the physical opportunities for developments to meet water needs; and (4) the broad economic aspects of possible development. The State will use this information to formulate and implement plans and programs to secure the most beneficial use and control of the area's water resources. The State's programs are intended, by legislative decree, to be dynamic in nature, with provision for changes as new information is available, and as the physical or economic situation changes. The current survey is only the beginning of the State's work in this area.

Upon request of the State Water Resources Board, the U. S. Department of Agriculture cooperated in this survey under the provisions of section 6 of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, as amended).

The broad objectives of the cooperative survey were to gather basic data and information pertinent to the use and control of water for agriculture in the area, to highlight such major water related problems as erosion, flood prevention, and drainage, and to outline a general program for water and related land resource management to be used as a background for future detailed study and planning. No final solutions are intended for it is felt that watershed planning must be a dynamic, continuing process requiring further cooperative work by all groups concerned.

This report should be of use to anyone interested in the area's land and water resources. It should be of value in appraisal of present and future use of water for agriculture in relation to other water uses for planning, evaluation, development, and operation of the various agricultural programs of Federal, State, and local agencies.

The survey consisted partly of an accumulation and evaluation of previously recorded data, both published and unpublished, much of which was furnished by other cooperating groups. In addition, the USDA Field Party made limited surveys to gather basic data that was not otherwise available including physical characteristics of certain reservoir sites, land and water availability and use, problems and needs for many tributary watersheds, and forest land resources and ownership. These were not detailed surveys, and much of the data was obtained through consultation with local, public, and private officials. The basic data used as a foundation for statistical information presented in this report are in the files of the USDA Field Party.

Several agencies and organizations provided helpful assistance in making this survey. The field offices of the Soil Conservation Service furnished

some of the basic data concerning reservoir sites and tributary watersheds. The County Extension Service and Agricultural Conservation and Stabilization Service also assisted in the collection of tributary watershed data. Most of the land status information was obtained from County Assessor's records of the counties concerned. Much of the forest land data was furnished by the various field offices of the U. S. Forest Service, the Pacific Northwest Forest and Range Experiment Station, the Bureau of Land Management, the State Forester of Oregon, and the West Coast Lumbermen's Association. Much of the agricultural data was obtained from publications of the U. S. Bureau of the Census. Several of the above-mentioned agencies also provided helpful consultation and comment concerning the preparation of this report. In accordance with the cooperative agreement, the State Water Resources Board developed and furnished information concerning existing water rights, major resources and their use, and other pertinent information in addition to furnishing hearing reports and numerous maps.

USDA REPORT ON WATER AND RELATED LAND RESOURCES

SOUTH COAST DRAINAGE BASIN, OREGON

SUMMARY

General Description of the Basin

The South Coast Drainage Basin of Oregon includes all coastal watersheds between the Umpqua River and the California state line except the Rogue River watershed. The basin has an area of 2,985 square miles, which is 3.1 percent of the area of the State of Oregon, and it includes portions of the Southern Coast Range and Klamath Mountains physiographic areas. The topography is characterized by a relatively narrow coastal plain and by narrow alluvial valleys extending into a mountainous interior. Elevations range from sea level to more than 5,000 feet. The climate is humid with a strong marine influence; it is characterized by high winter precipitation and moderate year-round temperatures.

Settlement of the basin, beginning in 1851, was on the basis of lumbering, mining, commercial fishing, and subsistence agriculture. Agriculture gradually expanded to include dairying, sheep and cattle ranching, and cranberry and lily bulb production. Lumbering expanded as transportation was improved and as the demand for wood products increased. Recently, recreation has rapidly increased in economic importance while mining and commercial fishing have decreased. About 58 percent of the basin's 68,000 inhabitants live in rural areas.

Approximately 58 percent of the basin is privately owned and 42 percent is publicly owned. About 89 percent of the basin is forested land; 4 percent is rangeland; 3 percent is cropland; and 4 percent is devoted to other uses.

Forestry

The dominant use of forest land in the basin is for timber production. There are more than 1.5 million acres of commercial forest land containing 34 billion board feet. The commercial forest land is estimated to have a potential annual sustained yield of 1.1 billion board feet, but the present timber growth is only about 0.6 billion board feet. Intensified management is needed to assure the full potential sustained yield. The lumber and plywood industries have an annual capacity of about 1.4 billion board feet, and the annual timber harvest has averaged about 1.1 billion board feet in recent years. The wood-using industries are gradually becoming more diversified to utilize wood that is not suitable for lumber or plywood. However, there is still a large quantity of wood that is not utilized.

Much of the forest land in the basin is used for recreation. For example, nearly 60,000 recreational visits were made to the national forests of the basin in 1960, and greatly increased recreational use is expected in the future. The economic importance of public recreation is steadily increasing. Recreation use is heaviest in the coastal area but is increasing in the interior with improved access. The public recreational facilities include 13

national forest campgrounds, 1 BLM campground, 29 state parks, and 11 county parks. There are two national forest recreation areas managed in near-natural condition, and a sizable acreage of publicly-owned forest land is in recreation zones surrounding lakes, streams, roads, and recreational facilities. Private forest landowners are permitting more public recreational use of their land. The public agencies plan to provide greatly increased recreational facilities in the future.

The forest land of the basin supports a sizable wildlife population that is a valuable asset to the people of the area. Hunting for big game such as blacktail deer and Roosevelt elk is a popular recreational activity. Many other species of wildlife are important for hunting or as part of the biotic community. The streams and lakes support several species of native and anadromous fish, and fishing is an important recreational activity.

Little of the forest land is suitable for livestock grazing, but a large area of forest land has been cleared and seeded to grass to provide range for livestock. Some of the cleared forest land cannot be profitably used for grazing so is being allowed to revert to forest.

Forest land management affects the quality, quantity, and timing of water yields. Water requirements related to forestry include both consumptive and nonconsumptive domestic, livestock, recreational, wildlife, fish life, and industrial needs. Water quality, as well as quantity, is important in meeting these needs. Most of the water requirements related to forestry will increase in the future.

Agriculture

The dominant agricultural activities in the basin are the production of milk, beef cattle, sheep, cranberries and lily bulbs, commodities well adapted to the physical and economic conditions.

The dominant use of agricultural land is for production of forage for livestock. About 81,700 acres of rangeland and 117,400 acres of forest land are grazed, and 52,340 acres of cropland are used for pasture and hay production. Although relatively small acreages are used for cranberry and lily bulb production, these crops have considerable economic importance.

The 1,358 farms in the basin average 280 acres in size. The average value of land and buildings is $30,780 per farm. The number of farms has decreased since 1944 while the average acreage and value per farm have increased. Most of the farmers own their farms.

The livestock population of the basin includes 12,130 milk cows, 23,650 other cattle, 63,180 sheep and lambs, 690 horses and mules, and 2,970 goats and kids. The trend in livestock numbers appears to be toward more sheep, lambs, and beef cattle, and fewer milk cows, goats, horses, and mules.

Agricultural income from the sale of crop and livestock products in the basin in 1959 was an estimated $6.8 million. Income from the sale of livestock products accounted for 78 percent of the agricultural income and crops accounted for 22 percent. Total farm income has increased each census

year since 1939.

The major agricultural uses of water in the basin are for production of forage, cranberries, lily bulbs, and livestock. An estimated 9,340 acres were irrigated in 1961 including 8,480 acres of pasture and/or hayland, 530 acres of cranberries, 290 acres of lilies, and 40 acres of other crops. Streamflows are the major source of water for irrigation, and sprinkler systems are used almost exclusively for applying water to the land. Pumps are the primary means of diverting water from its source to the land. Irrigation did not become a widespread practice until after 1944.

An estimated 51,600 acres of land in the basin is irrigable. Natural streamflows are adequate to irrigate about 32 percent of this land. Future irrigation development will be governed by several physical and economic factors.

Water Related Problems

Major water related problems in the basin include those of seasonal water supply, drainage, flooding, erosion, and sedimentation. Some watersheds already have seasonal water shortages, and increased seasonal water supplies will be required for future irrigation and industrial needs. About 35,000 acres of agricultural land need improved drainage.

Heavy winter storms and resulting heavy runoff cause great damage in the basin. On forest land, timber harvesting and road construction increases the erosion and flood damage hazards. Often the vegetative cover over the soil is removed; the soil is disturbed; natural drainage is disrupted; and stream channels are blocked with slash and debris. Overgrazing, burning of mixed forest and range areas, and mineral exploration and development also increase the erosion and flood damage hazards.

Floodwater damage is widespread in the valley agricultural areas. The inundation of low farm land areas aggravates drainage problems, overloads drainage structures, and destroys pasture plantings. Arable land is lost through streambank erosion. Sediment and debris carried by floodwaters cause serious damage to arable land and increase maintenance and repair costs of roads, railroads, and harbors. Streambed sedimentation and debris jams are harmful to fish life.

Needs and Opportunities for Improved Management of Water and Related Land Resources

There is a need for continuing maintenance and improvement of the condition of all tributary watersheds in the basin. Good watershed management on forest land is closely related to the economic benefits derived from sustained yield production of timber and other forest products. There is a need for markets to utilize wood that is presently wasted, for better planned timber harvesting operations, and for rehabilitation of poorly stocked logged and burned-over forest land. Better management of small forest ownerships needs to be encouraged. Forest land managers and owners need to give increased recognition to values of forest land as recreation areas, habitat for wildlife, and watersheds.

The forest cover should be restored and encouraged on some land presently used for grazing. Areas that are suitable for continued range use need more intensive development and management including reseeding, control of encroaching undesirable vegetation, and rotation and deferred grazing.

There is a need for improvement and maintenance of good cropland management including conservation cropping systems, erosion control, improved irrigation, and drainage. Additional water development is needed in some areas to provide for expansion of irrigation. There are many potential water storage sites in the basin.

Many of the water related problems of the basin are of the types that can be solved under the provisions of the Watershed Protection and Flood Prevention Act. However, under existing conditions and laws it appears that the solution of these problems may be practical and economical in only a few watersheds at this time.

Coordinated action by all agencies, organizations, and individuals concerned is needed if the best use of the basin's land and water resources is to be realized.

GENERAL DESCRIPTION OF THE BASIN

LOCATION AND SIZE

The South Coast Drainage Basin of Oregon includes all coastal drainages between the Umpqua River Basin and the California state line, except for the Rogue River Basin (fig. 1). It is divided into two separate geographic areas by the Rogue River Basin. It is bounded on the north by the Umpqua River Basin, on the east by the Umpqua and Rogue River Basins, on the extreme south by the California-Oregon state line, and on the west by the Pacific Ocean. It includes major portions of Coos and Curry Counties and a minor portion of Douglas County and has a total area of about 2,985 square miles, about 3.1 percent of the total area of Oregon.

For the purpose of this report, the South Coast Basin is divided into four subbasins. Subbasin 1, 2, and 3, the Sixes, Coquille, and Coos Subbasins, respectively, are north of the Rogue River Basin while subbasin 4, the Chetco Subbasin, is between the Rogue River Basin and the California state line.

Subbasin 1, the Sixes Subbasin, includes all coastal watersheds from Fourmile Creek south to the Rogue River Basin. The largest watersheds in this subbasin are the Elk and Sixes Rivers and Fourmile, Floras, and Euchre Creek. It is the smallest subbasin with an area of about 440 square miles.

Subbasin 2, the Coquille Subbasin, includes the Coquille River and its tributaries and several adjacent small watersheds. It is the largest subbasin with about 1,095 square miles.

Subbasin 3, the Coos Subbasin, has an area of 730 square miles and includes the watersheds between the Coquille Subbasin and the Umpqua River Basin. The major watershed area in this subbasin is the Coos River with its two largest tributaries, the Millicoma and Williams Rivers.

Subbasin 4, the Chetco Subbasin, has an area of 720 square miles and includes the Pistol, Chetco, Winchuck, and North Fork Smith Rivers and several smaller watersheds.

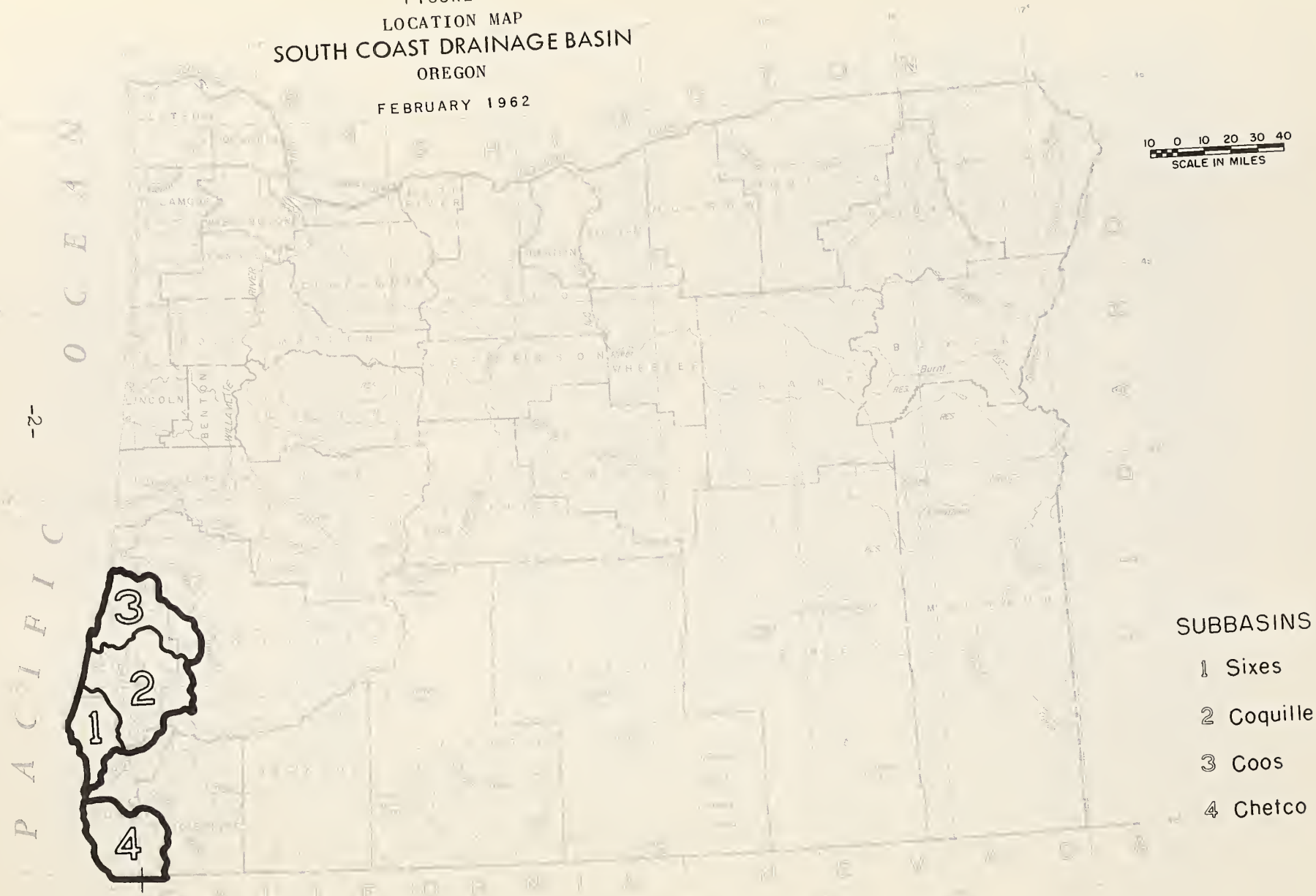
PHYSICAL ASPECTS

Topography

The South Coast Drainage Basin lies within the Southern Coast Range and Klamath Mountains physiographic areas. The line between these two physiographic areas lies approximately along the Middle Fork of the Coquille River.

The coastal front of the basin is characterized by four types of topography: rocky, rugged headlands, relatively level terraces, alluvial floodplains on bottomlands adjacent to present streams, and sand dunes. Tidal estuaries extend inland along the drowned channels of several streams, notably on the Coquille River and at Coos Bay. Windblown sand has partially blocked the drainage of many smaller streams forming fresh water lakes in the drowned valleys at or near sea level. The area of active sand dunes is restricted to a band within five miles of the ocean. Terraces, the remnants of prehis-

FIGURE 1
LOCATION MAP
SOUTH COAST DRAINAGE BASIN
OREGON
FEBRUARY 1962



toric ocean beaches, tidal areas, and bottomlands extend several miles inland.

The Southern Coast Range is relatively rugged. The main river valleys are well entrenched and lie generally at elevations below 500 feet. The river gradients are gentle except near the headwaters, and the valley bottoms are seldom more than 1/2 mile wide. Tributary drainages consist of narrow canyons of a much steeper gradient with many waterfalls. The Coast Range summit in this area varies from less than 1,500 feet to over 3,000 feet in elevation. The ridgetops are narrow and sharp. The mountain range trends in a north-south direction. There are many areas of precipitous topography, but they are usually not extensive.

The Klamath Mountains physiographic area is much more rugged. Rivers have fairly uniform steep gradients, and the river valleys are very narrow with little flat ground below the steep canyon slopes. Several of the mountain summits along the Rogue-Coquille Divide are near 4,000 feet elevation, and summit elevations in the Chetco Subbasin reach a maximum of 5,098 feet at Pearsoll Peak. Much of the upper Chetco and North Fork Smith River watersheds have extremely rugged terrain interspersed with a few plateaulike summits that are remnants of old erosion surfaces. The mountain ridges present a jumbled pattern running in many directions.

Geology and Soils

The Southern Coast Range of Oregon was formed by a rapid uplift which has the shape of a broad arch interspersed with many minor folds. Most of the bedrock geology consists of eocene sedimentary formations, principally sandstones and shales, with many igneous intrusions of dense, dark basalt. The sedimentary formations have been rapidly eroded producing the rounded appearance of most of the Coast Range terrain. The igneous intrusions are much more resistant to erosion and form a resistant cap on many of the higher ridges and prominent headlands along the ocean. Extensive coal beds are found southeast of Coos Bay and in the Eden Ridge area south of Powers.

The Coast Range soils are generally shallow to very deep silt-loams and clay-loams. These soils are extremely susceptible to landslides. Slides consisting of large masses of sedimentary rock have also occurred, sometimes damming the narrow river valleys to form lakes.

The Klamath Mountain physiographic area consists largely of pretertiary strata that are steeply folded and faulted and intruded by serpentinized masses of ultrabasic rocks. The southern Oregon serpentine belt is one of the largest such areas in the world. Other formations consist of sandstone, siltstone, and shales that have been altered to schists and phyllites with other secondary structural types, and these are generally among the oldest rocks in Oregon.

Soils developed in residuum from serpentine rock are dominantly shallow with associated very deep slump areas on lower parts of slopes. The soils inherit an unbalanced nutrient level from the serpentine rock that is high in magnesium and iron and low in calcium. For this reason, the serpentine soils tend to be sparcely vegetated. The other Klamath Mountain soils are highly variable.

Along the coast the geology is strongly influenced by the ocean. During past glacial periods, the ocean probably has been as much as 400 feet lower than the present level causing downcutting of many stream valleys below the present sea level. During interglacial periods the ocean level was much higher, possibly 200 feet higher than its present level. During these periods depositional terraces were laid down in the shallow coastal areas. These terraces have since been uplifted, eroded, and tilted, but remnants of them still remain. Since the most recent ice age, the ocean has risen drowning the coastal valleys and creating estuaries along the main rivers. These estuaries are rapidly being filled by alluvium. Several small, slow-flowing streams have been partially blocked by windblown sand forming fresh water lakes.

Most of the arable land is either on bottomlands in the narrow alluvial valleys or on the terrace remnants.

The Soil Conservation Service has a practical way of grouping soils called "Land Capability Classification". Soil characteristics and qualities such as permeability, water-holding capacity, depth, inherent fertility, texture, structure, wetness, acidity, overflow hazards, slope, and also climatic conditions as they influence use, management, and productivity of land were considered in grouping soils into eight land capability classes. These eight classes are designated by Roman numerals as indicated on the "Generalized Land Capability Map" (fig. 2). The hazards and limitations of use of the groups increase as the class number increases. Class I land has few hazards or limitations, whereas Class VIII land is so limited that it is unfit for safe or economical cultivation and grazing. It should be used only for recreation, wildlife habitat, and watershed.

Generally speaking, the classification can be broken into two divisions: (1) land in capability classes I through IV is land suited for cultivation and other uses, and (2) land in capability classes V through VIII is best suited for range, forestry, and wildlife because of its own limitations. Land capability classes are sometimes broken down into subclasses to indicate the dominating limitation or hazard. The subclasses are: "e" for wind or water erosion, "w" for wetness or frequent inundation from overflow, "s" for soil limitation, and "c" for climatic limitations.

An estimate of the amounts of land in each subbasin has been made for each land capability class and subclass. These data were developed from the Conservation Needs Inventories from those counties within the South Coast Basin and are summarized in table 1. The general location of the major groups within the South Coast Basin is shown in figure 2.

Climate

The South Coast Basin has a humid climate with a strong marine influence characterized by high precipitation particularly during the winter months and by moderate year-round temperatures. The mountainous topography produces considerable local variation in the climate.

The annual precipitation is 60 to 80 inches along the immediate coast but increases inland to as much as 120 inches or more along the summit of the Coast Range. Most of the precipitation occurs from November through March

DRAINAGE BASIN LOCATION

COUNTY LOCATION

SUBBASINS

1 SIXES
2 COQUILLE
3 COOS
4 CHETCO

LEGEND

LAND SUITED FOR CULTIVATION AND OTHER USES

CLASS II — Soils in Class II have few limitations or hazards. Simple conservation practices are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland, or wildlife.

CLASS III — Soils in Class III have more limitations and hazards than those in Class II. They require more difficult or complex conservation practices when cultivated. They are suited to cultivated crops, pasture, range, woodland, or wildlife.

CLASS IV — Soils in Class IV have greater limitations and hazards than Class III. Still more difficult or complex measures are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland, or wildlife.

LAND LIMITED IN USE--GENERALLY NOT SUITED FOR CULTIVATION

CLASS VI — Soils in Class VI have severe limitations or hazards that make them generally unsuited for cultivation. They are suited largely to pasture, range, woodland, or wildlife.

CLASS VII — Soils in Class VII have very severe limitations or hazards that make them generally unsuited for cultivation. They are suited to grazing, woodland, or wildlife.

CLASS VIII — Soils and land forms in Class VIII have limitations and hazards that prevent their use for cultivated crops, pasture, range, or woodland. They may be used for recreation, wildlife, or water supply.

SUBCLASSES

E Erosion
S Soil
W Wet or Overflow

Drainage Basin Boundary
Subbasin Drainage Basin Boundary
National Forest Boundary
Land Capability Class Boundary

FIGURE 2
GENERALIZED LAND CAPABILITY CLASSES
SOUTH COAST DRAINAGE BASIN
OREGON

FEBRUARY 1962

SCALE IN MILES

Table 1.--Estimated acreage of land by capability class and subclass, South Coast Drainage Basin, Oreg., 1961

Land capability class	Subbasin 1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
	Acres	Acres	Acres	Acres	Acres
I	1,400	2,650	2,700	2,250	9,000
IIe	7,300	850	1,800	13,850	23,800
IIw	1,350	500	1,000	200	3,050
IIs	...	4,200	8,800	...	13,000
Total II	8,650	5,550	11,600	14,050	39,850
IIIe	3,350	300	200	6,850	10,700
IIIw	900	33,800	22,500	100	57,300
IIIs	1,050	2,950	1,950	1,650	7,600
Total III	5,300	37,050	24,650	8,600	75,600
IVe	4,700	49,750	68,500	15,600	138,550
IVw	5,450	2,750	3,800	900	12,900
IVs	4,000	...	...	6,500	10,500
Total IV	14,150	52,500	72,300	23,000	161,950
Subtotal	29,500	97,750	111,250	47,900	286,400
VIe	84,250	167,850	111,800	137,050	500,950
VIw	9,100	2,500	1,700	14,800	28,100
VIs	...	4,850	3,200	...	8,050
Total VI	93,350	175,200	116,700	151,850	537,100
VIIe	152,450	380,100	210,700	248,050	991,300
VIIs	...	32,000	17,750	...	49,750
Total VII	152,450	412,100	228,450	248,050	1,041,050
VIIIe	4,200	15,100	10,100	6,800	36,200
VIIIs	3,400	...	...	5,550	8,950
Total VIII	7,600	15,100	10,100	12,350	45,150
Subtotal	253,400	602,400	355,250	412,250	1,623,300
Total	282,900	700,150	466,500	460,150	1,909,700

Source: Compiled by USDA, Soil Conservation Service.

often in moderate to heavy storms that produce up to six inches or more precipitation in a 24 hour period. The normal annual snowfall varies from a trace near the coast to several feet in the higher mountains, where it may accumulate to a depth of two to four feet and remain through the winter. Winter snow accumulations do not materially affect the streamflow pattern in this area. Summer precipitation is limited to occasional light rainstorms, relatively rare thundershowers, and coastal fog.

The prevailing winds are generally from the west and northwest. During stormy periods, the prevailing wind directions are from the south or south-

west and may reach destructive velocities. Continuous wind velocities of 15 to 25 miles per hour are common at many points along the immediate coast. The wind velocities are more moderate in the inland valleys, but strong winds caused by daily temperature variations are common in narrow canyons and on upper mountain slopes during the summer. Occasional short periods of strong easterly winds may occur at any time of the year.

High relative humidities are common year-round near the coast and in the interior during the rainy season. Summer humidities are usually fairly high in the interior of the Coos and Coquille Subbasins, and coastal fog frequently extends 20 to 30 miles up the river valleys at night. Summer humidities are often low in the interior of the Chetco Subbasin, and fog is usually restricted to the immediate coast. The easterly wind periods mentioned previously are accompanied by very low humidities even in the coastal areas.

The winter temperatures are mild, seldom dropping below 20 degrees even in the mountains. The summer temperatures are cool in the coastal fog belt but are fairly high further inland particularly in the Chetco Subbasin. Even here, temperatures above 100 degrees are rare.

The average frost-free season varies from more than 250 days along the coast to about 150 days in the mountains. It is 200 days or longer in most agricultural areas.

SETTLEMENT AND HISTORY

The first settlement in the basin was at Port Orford in 1851. Gold was discovered along the beaches between Coos Bay and Gold Beach in 1852-53, leading to establishment of several settlements. Lumbering rapidly became important as forests were cleared around Coos Bay and along the major rivers, and ocean-going lumber freighters began calling at Coos Bay for cargoes.

Commercial fishing also began quite early and remained at a high level until about 1950 when the commercial fishery shifted to ports outside the basin. However, the sports fishery has steadily increased in importance since the 1930's.

The sub-bituminous coal resources of the Coos Bay area were first exploited during the 1860's, and shipments surpassed 100,000 tons annually between 1900 and 1910.1/ Operations ceased as oil replaced coal as a commercial fuel, although sizable coal reserves remain. The more recent mining activities have included chromium mining in the coastal areas and inland in the Chetco Subbasin, limited prospecting for gold, nickel and other metals, and mining of common sand, gravel, and stone.

Economic development of the basin was impeded by inadequate transportation, which in the early days consisted of pack train and ocean freighter. The first farms were thus located near the coast and were mostly small, self-sustaining operations marketing products such as butter, cheese, wool, hams, and a few beef cattle. The completion of the Coos Bay Wagon Road in 1893, the railroad from Eugene to Coos Bay in 1916, and the all-weather highways

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1/ "The Economic Base for Power Markets in Coos County, Oregon." Bonneville Power Administration, 1943.

along the coast and to the interior in the 1930's helped to cause successive expansions in agriculture. The production of dairy products was increased until the 1940's but has declined slightly since then. Sheep production was increased rapidly after 1920 with widespread conversion of cutover forest land to pasture. Cranberry production began in 1885 and has increased slowly but steadily since then. Easter lily production was developed very rapidly in the 1940's in the Brookings area but decreased in the 1950's to a level where it has remained fairly constant.

The logging and forest products industries also experienced rapid growth with improved transportation, more efficient equipment, and a strong demand for lumber during World Wars I and II. Development of a diversified wood products industry and rising stumpage values have created an interest in sustained-yield forestry. Forest values for recreation, watershed protection, and other purposes are gaining increasing importance to people of the area.

POPULATION

In 1960, the population of the South Coast Basin was about 68,000. Almost half of the inhabitants reside in the Coos Subbasin (table 2). The largest concentration of people is in the Coos Bay area in the cities of North Bend, Coos Bay, Empire, and Eastside which have a combined population of 19,757. All other towns in the Coos Subbasin have populations of less than 1,000.

Table 2.--Population distribution, South Coast Drainage Basin, Oreg., 1960

Place of residence	Number of inhabitants				
	Subbasin				
	1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
	Number	Number	Number	Number	Number
Urban areas 1/	...	7,616	18,377	2,637	28,630
Rural areas:					
Cities and towns 2/	1,496	4,869	3,110	1,890	11,365
Farms	650	3,000	1,350	450	5,450
Other	3,354	4,315	11,813	3,073	22,555
Total	5,500	19,800	34,650	8,050	68,000

1/ Urban areas are defined by the U. S. Census of Population as cities having 2,500 or more inhabitants.
2/ Cities and towns with fewer than 2,500 inhabitants.

Source: Rural farm population estimated on the basis of number of farms in each subbasin. Other data furnished by the State Water Resources Board of Oregon.

The Coquille is the second most populous subbasin with 19,800 inhabitants. Over half of the farm population is in this subbasin. The largest city is Coquille with a population of 4,730. Myrtle Point, Bandon, and Powers with populations of 2,886, 1,653, and 1,366 respectively are the only other cities in this subbasin with populations of over 1,000.

The Chetco Subbasin has 8,050 inhabitants. Brookings and Gold Beach, with 2,637 and 1,765 inhabitants respectively, are the only cities in this subbasin with populations of over 1,000.

The Sixes Subbasin, with 5,500 inhabitants, has the smallest population of any of the four subbasins. Port Orford, with a population of 1,171, is the only city in this subbasin with more than 1,000 inhabitants.

About 42 percent of the population live in urban areas; 17 percent live in smaller cities and towns; 8 percent live on farms; and 33 percent live in other rural areas.

The total population of the basin has increased during each ten year census interval since 1870. Figure 3 shows the population growth for Coos and Curry Counties. The rate of growth has been especially high since 1940. From 1940 to 1960 population in the two counties increased at a rate of about 3.2 percent per year compared to 2.5 percent for the State of Oregon. The decline in rural farm population since 1940 has been more than offset by an increase in rural nonfarm population. Urban population increased substantially from 1950 to 1960.

TRANSPORTATION

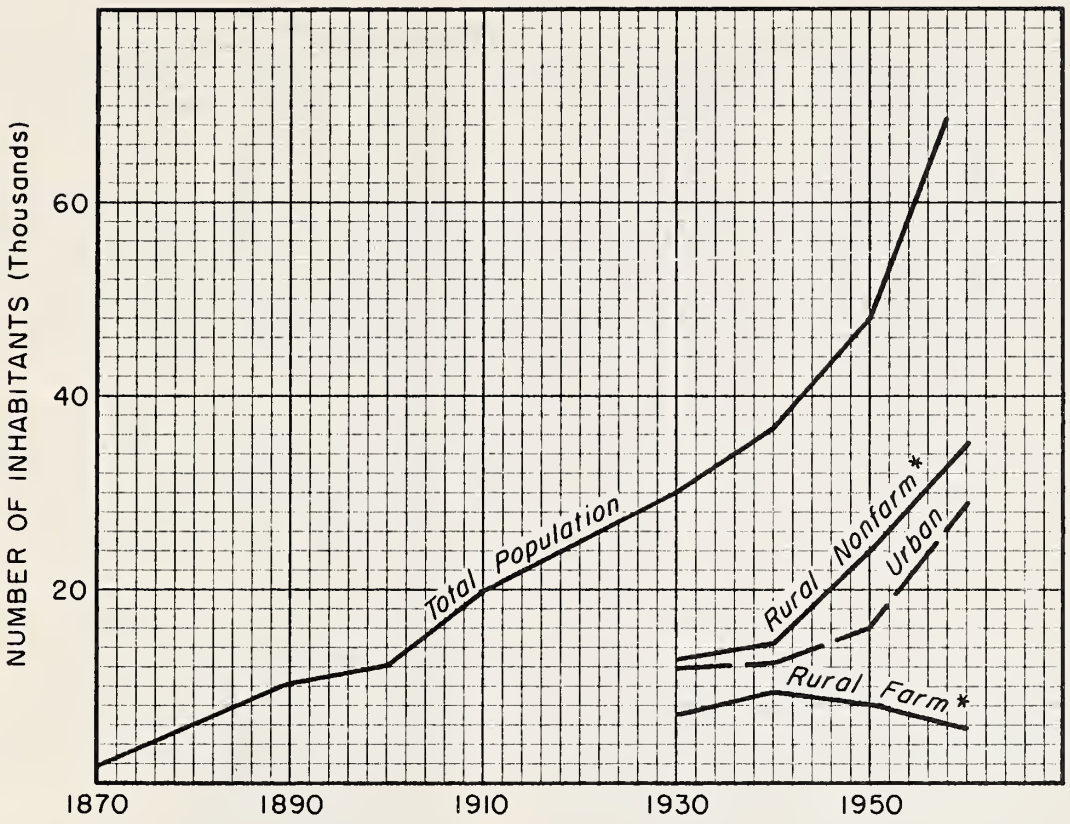
U. S. Highway 101 is the main highway through the South Coast Basin generally following the coast and connecting the main agricultural and industrial areas. Oregon Highway 42 from Coquille to Roseburg is the only surfaced east-west route through the basin, though there are other routes to the interior through Reedsport, Oreg., to the north, and Crescent City, Calif., to the south. Secondary roads extend up many of the watersheds. There is regular bus and freight truck service on all the main highways.

A branch rail line from Eugene, Oreg., through Reedsport, Coos Bay, Coquille, and Powers provides express and freight service to Coos County. There is no railroad in Curry County.

There is scheduled airline service to North Bend and to Crescent City, Calif., which is immediately south of the Chetco Subbasin. In addition, the airports at Arago, Bandon, Brookings, Gold Beach, Lakeside, Powers, and Sixes are classified for public use by the Oregon State Board of Aeronautics.

The most important seaport is Coos Bay, the only deep water harbor between the Columbia River and San Francisco. Approximately 16 million dollars of federal funds have been spent in deepening the Coos Bay channels to accommodate ocean-going freighters, building jetties, and developing a small craft basin. The Corps of Engineers, U. S. Army, is responsible for the development and maintenance of these facilities. The shore facilities include 2 public and 13 private docks. Approximately 1.5 million tons are shipped through the port annually.

Bandon, Port Orford, Gold Beach, and Brookings also have port facilities. Improvements have been constructed at Bandon and Gold Beach by the Corps of Engineers, U. S. Army, but only Bandon has a public dock. These ports are too shallow for ocean-going freighters, so shipments must be carried by barges or smaller craft.



Source: U.S. Census of Population.
** 1960 rural farm and rural nonfarm population estimated on basis of numbers of farms in 1960.*

Figure 3: Population of two principal counties in the South Coast Drainage Basin, Oregon, 1870-1960.

LANDOWNERSHIP

In this study, landownership in the South Coast Drainage Basin is classified as federal, state, county and municipal, and private. Figure 4 shows the general location of the various ownerships, and table 3 shows the ownership distribution for each subbasin.

About 58 percent of the South Coast Basin is privately owned. Forty percent of the private land is held by 16 individuals or corporations, defined as class 1 or 2 forest landowners by the U. S. Forest Service's 1952 Timber Resources Review (owners of 5,000 or more acres of forest land in Oreg.). These are referred to hereafter as "large private" owners. Most of the large private holdings are in the mountainous timbered areas.

The remaining 60 percent of the private land is owned by ranchers and farmers, class 3 forest owners (those owning less than 5,000 acres of forest land), and other owners. Most of these "small private" holdings are within 15 miles of the ocean or in and adjacent to the valleys of the Coquille River and its main tributaries.

About 36 percent of the South Coast Basin is in federal ownership. Two-thirds of this land is in national forests administered by the U. S. Forest Service. There are blocks of national forest land in the southern portion of the Sixes and Coquille Subbasins, along the coast north of Coos Bay in the Coos Subbasin, and in the Chetco Subbasin where two-thirds of the land is in the Siskiyou National Forest.

Most of the remaining federal land is administered by the Bureau of Land Management including national land reserve, Oregon and California Railroad revested land, and Coos Bay Wagon Road revested land. Most of this land is in the eastern Coos and Coquille Subbasins intermingled with private land in a checkerboard pattern.

The State of Oregon owns about 5 percent of the South Coast Basin. Sixty percent of this is in the Elliot State Forest in the northeast portion of the Coos Subbasin. Fourteen percent of the state owned land is in state parks, most of which are along the immediate coast. The remainder consists of small tracts administered by the State Land Board, highway rights-of-way, and large bodies of water.

Counties and municipalities own about 1 percent of the South Coast Basin. About 60 percent of this is in the Coos County Forest located northwest of Coquille along the divide between the Coos and Coquille Subbasins. The remainder is scattered in tracts of a section or less.

Land Use

The predominant land uses in the South Coast Basin are for forest and for agriculture. The generalized pattern of land use in the basin is shown in figure 5, and table 3 presents an estimate of land use by ownership class.

About 89 percent of the basin is forested. Eighty-two percent of the basin is commercial forest land.1/ Seven percent is noncommercial and reserved forest land.2/ The noncommercial forest land is in scattered tracts with-

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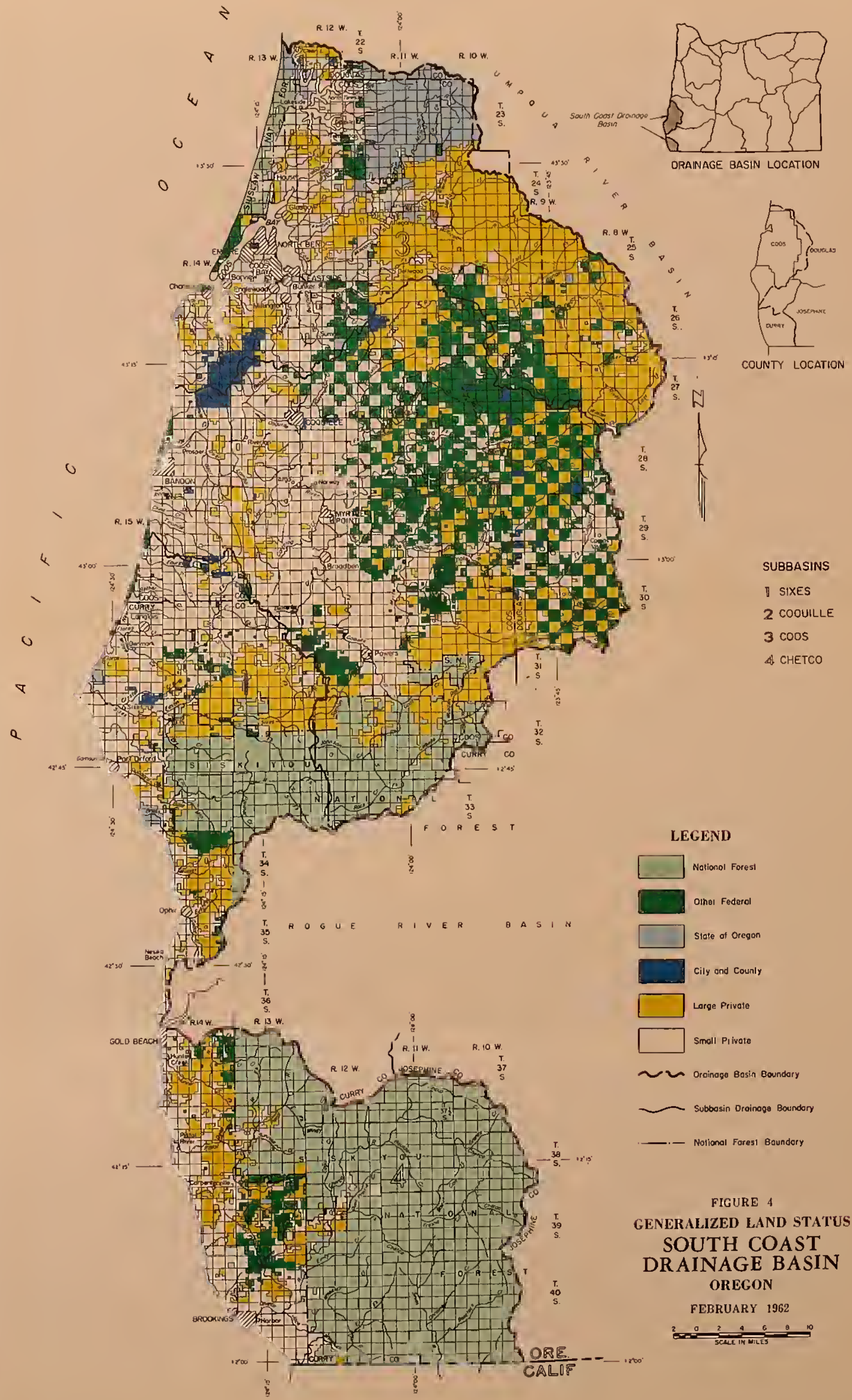
M-3627



DRAINAGE BASIN LOCATION

COUNTY LOCATION

FIGURE 4

GENERALIZED LAND STATUS

SOUTH COAST DRAINAGE BASIN

OREGON

FEBRUARY 1962

7-E-1690-N

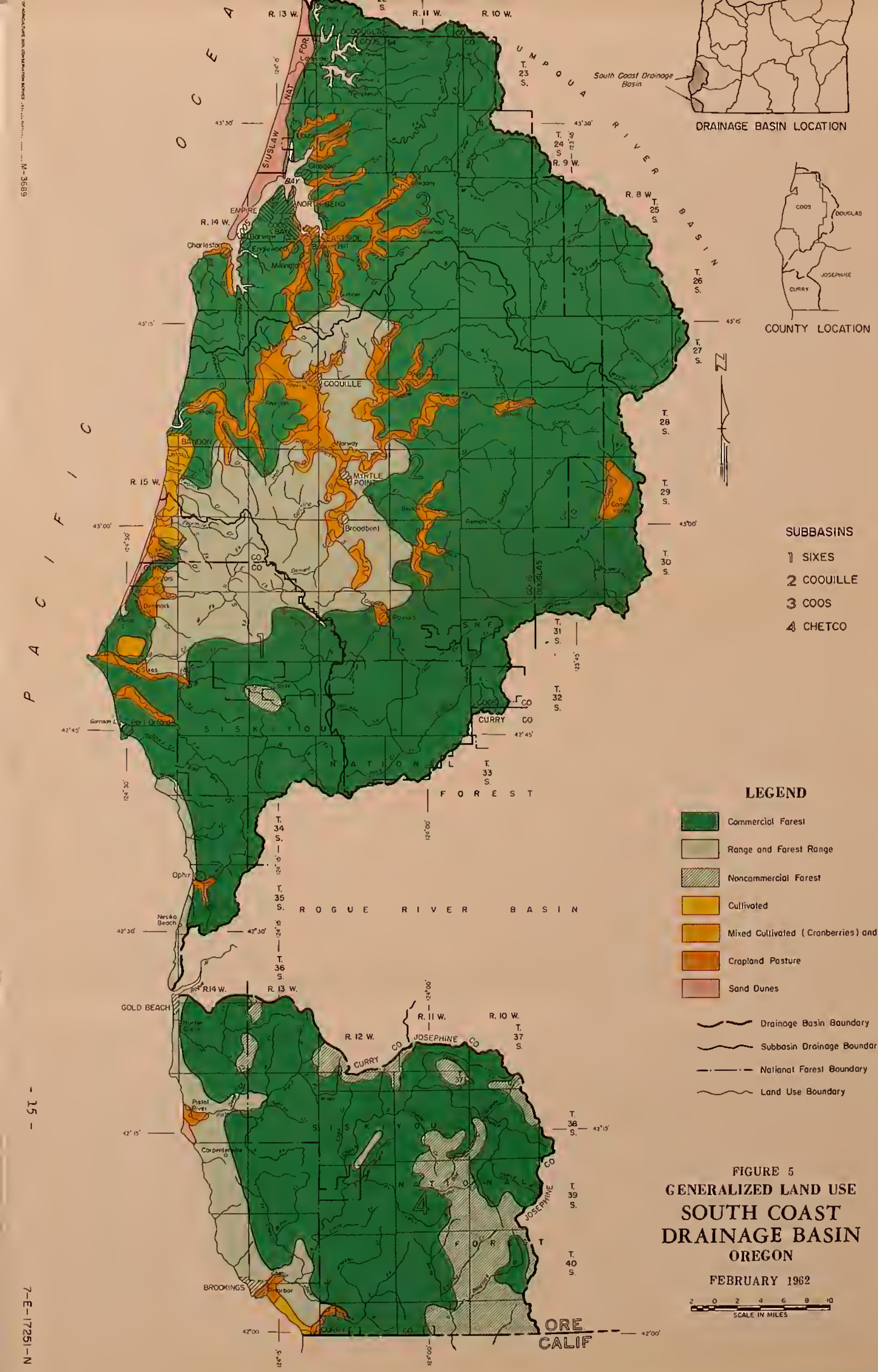


FIGURE 5

GENERALIZED LAND USE

SOUTH COAST DRAINAGE BASIN

OREGON

FEBRUARY 1962

M-3689

7-E-17251-N

Table 3.--Land use and ownership, South Coast Drainage Basin, Oreg., 1961

Class of ownership	1. Sixes Subbasin — Land use						2. Coquille Subbasin — Land use					
	Commercial forest	Noncommercial and reserved forest	Cropland	Rangeland	Other	Total	Commercial forest	Noncommercial and reserved forest	Cropland	Rangeland	Other	Total
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
National forest	69,050	2,300	...	...	1,300	72,650	64,250	4,250	...	...	300	68,800
Other federal	9,350	1,200	...	...	500	11,050	148,450	7,100	...	...	2,500	158,050
State of Oregon	700	2,450	...	...	1,600	4,750	250	200	...	...	2,100	2,550
County and municipal	300	650	...	...	1,200	2,150	10,300	500	...	...	400	11,200
Large private	61,700	500	...	...	700	62,900	148,950	500	...	...	1,100	150,550
Small private	96,100	500	7,900	21,900	3,000	129,400	225,550	500	33,750	42,500	6,700	309,000
Total	237,200	7,600	7,900	21,900	8,300	282,900	597,750	13,050	33,750	42,500	13,100	700,150

Class of ownership	3. Coos Subbasin — Land use						4. Chetco Subbasin — Land use					
	Commercial forest	Noncommercial and reserved forest	Cropland	Rangeland	Other	Total	Commercial forest	Noncommercial and reserved forest	Cropland	Rangeland	Other	Total
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
National forest	...	5,000	...	...	3,650	8,650	204,950	99,350	...	600	1,500	306,400
Other federal	37,600	3,300	...	...	2,600	43,500	15,650	1,450	...	...	200	17,300
State of Oregon	54,050	4,400	...	...	21,000	79,450	950	1,550	...	...	2,700	5,200
County and municipal	9,200	550	...	...	300	10,050	200	...	...	...	100	300
Large private	184,700	500	...	...	1,300	186,500	42,300	300	...	...	300	42,900
Small private	112,150	500	10,550	3,100	12,050	138,350	69,150	200	2,550	13,600	2,550	88,050
Total	397,700	14,250	10,550	3,100	40,900	466,500	333,200	102,850	2,550	14,200	7,350	460,150

Class of ownership	Total South Coast Basin — Land use					
	Commercial forest	Noncommercial and reserved forest	Cropland	Rangeland	Other	Total
	Acres	Acres	Acres	Acres	Acres	Acres
National forest	338,250	110,900	...	600	6,750	456,500
Other federal	211,050	13,050	...	...	5,800	229,900
State of Oregon	55,950	8,600	...	...	27,400	91,950
County and municipal	20,000	1,700	...	...	2,200	23,700
Large private	437,650	1,800	...	...	3,400	442,850
Small private	502,950	1,700	54,750	81,100	24,300	664,800
Total	1,565,850	137,750	54,750	81,700	69,650	1,909,700

Source: Estimated from data furnished by Soil Conservation Service, Forest Service, Bureau of Land Management, State of Oregon, and the County Assessors of Coos, Curry, and Douglas Counties, Oreg.

in the commercial forest areas. Much of the noncommercial forest land consists of areas of serpentine soil and/or rugged topography in the Chetco Subbasin and areas with sandy soils near the coast. The reserved forest land is in public parks.

About 3 percent of the basin is cropped. Most of the cropland is located on the valley floors adjacent to major streams. The principal crops produced include forage for livestock, cranberries, and lily bulbs.

About 4 percent of the basin is range. Rangeland includes natural "prairies" where trees have never grown and land that was originally forested but not cleared and seeded to grass. Most of the rangeland is in the Coast Range foothills adjacent to the Coquille River valley and near the coast in the Sixes and Chetco Subbasins. The rangeland is usually intermingled with forested land. Cropland and rangeland are further discussed in the agriculture section of this report.

About 4 percent of the basin is used for other purposes such as cities, towns, rural residential areas, and homesites. This also includes roads, highways, airports, rivers, streams, lakes, and other nonvegetative areas.

1/ Land that is physically capable of growing crops of commercial timber and is not reserved from commercial timber harvesting by statuatory or administrative authority.

2/ Land that is physically incapable of producing crops of commercial timber or is reserved from commercial timber harvesting.

INTRODUCTION

Sharp variations in soils, microclimate and topography, the existence of 18 softwood and 11 hardwood tree species, and a past history of extensive fire make the forests of the South Coast Drainage Basin the most variable in Oregon.

Coniferous forests, with Douglas-fir as the most abundant species, are the rule, but there is much local variation. There are extensive forests of Sitka spruce and Western hemlock in a strip varying from 1 to 10 miles wide along the immediate coast. These species are well adapted to the wet climate and are comparatively resistant to crown damage by the strong prevailing winds. Shore pine (Pinus contorta var. contorta Dougl.) occurs on sandy soils in the coastal strip while redwood stands are found in the lower Winchuck and Chetco Drainages. Douglas-fir forests, with Western hemlock as the principal associated species, are predominant further inland in the Sixes, Coos, and Coquille Subbasins. Western red cedar and, in the Sixes and southern Coquille Subbasins, Port Orford-cedar are important stand components (fig. 6). Sugar pine

Figure 6 This 110 year old Douglas-fir - Western hemlock - Port Orford-cedar stand is typical of the forests of the Sixes Subbasin.

and incense-cedar occur on dry sites in the southern Coquille Subbasin. Nearly-pure stands of Douglas-fir are common in the interior of the Chetco Subbasin, where the summer climate is much drier than farther north. Stunted stands of Jeffrey pine, lodgepole pine, knobcone pine, and incense-cedar occur on the serpentine soils common in the North Fork Smith River and upper Chetco River Drainages.

The hardwood species are widespread as an understory component in the coniferous stands and are the most abundant species on moist bottomland sites. Hardwoods also invade burned-over and logged-off areas. On the wetter sites red alder is the most abundant hardwood species forming extensive pure stands. It is relatively short-lived and is usually succeeded by coniferous species. Evergreen hardwood brush and tree species such as tanoak, Pacific madrone, canyon live oak, and manzanita occur on drier sites, particularly on south slopes, and may hinder establishment of coniferous species for many years. Extensive pure stands of evergreen hardwoods of merchantable size occur in the Chetco Subbasin.

Forest landownership in the basin is divided among the Federal government, the State of Oregon, counties and municipalities, and private owners (table 3).

Federal forest land consists primarily of land administered by the U. S. Forest Service and the U. S. Bureau of Land Management. Land administered by the U. S. Forest Service is in the Siskiyou and Siuslaw National Forests (fig. 4). The Siskiyou National Forest within the South Coast Basin consists of two blocks of land, one in the South Fork Coquille, Sixes, and Elk River Drainages of the Sixes and Coquille Subbasins, and the other in the Chetco Subbasin. The Siuslaw National Forest within the South Coast Basin consists of a narrow strip of land along the coast north of Coos Bay. Most of the forest land administered by the Bureau of Land Management is in the Coquille Subbasin. There is a smaller acreage of BLM land in each of the other three subbasins.

Most of the forest land owned by the State of Oregon is in the Elliot State Forest, which is partly in the Coos Subbasin and partly in the adjoining Umpqua River Basin. There are several smaller tracts of state-owned forest land, mostly in state parks.

Most of the county and municipal forest land is in the Coos County Forest in the Coquille and Coos Subbasins northwest of Coquille.

About 47 percent of the private forest land is owned by 16 "large private" owners. Eleven of these owners have more than 10,000 acres in the basin, the largest holding being about 160,000 acres. There are blocks of large private lands in the headwaters of the Sixes River in the Sixes Subbasin, in the Bone Mountain-Eden Ridge area in the southeast part of the Coquille Subbasin, and in the Coos and Millicoma River drainages in the Coos Subbasin. Other large private holdings are intermingled with lands of other ownership throughout much of the basin.

About 53 percent of the private forest land is owned by about 3,300 "small private" owners. Small private forest landownerships average about 150 acres. About 40 percent of the small private forest ownerships are small-

er than 100 acres.1/

The forests of the South Coast Basin, like others in Oregon, are undergoing a period of rapid conversion from a status of limited wildland management to a status of intensive development and use. This process began a little later here than in the more accessible parts of the state but has progressed very rapidly. There has been rapid harvesting of the old-growth timber from much of the basin. Recreational use of forest land is increasing rapidly resulting in crowding of the camp and picnic areas. Hunting and fishing are gaining in popularity. The increasing population and expanding forest products industry require large amounts of pure water. Forest land is the source of almost all this water. It can also be the source of flood waters, silt, and debris, which result in great damage to valuable land and improvements downstream. Thus, the forest resources of the South Coast Basin are of great importance to the people of southwestern Oregon and are of vital importance to the people of Coos and Curry Counties.

PROTECTION OF THE FORESTS

Fire Protection

Protecting the forests from fire within the national forests of the South Coast Basin is a responsibility of the U. S. Forest Service. Fire protection outside the national forests is a responsibility of the Coos Forest Protective Association of the Oregon State Department of Forestry.

Parts of the South Coast Basin have a history of man-caused forest fires almost without equal in the Pacific Northwest. Early-day settlers used fire to clear the land for agriculture, and they often allowed their clearing fires to burn uncontrolled. Miners set fires to burn off the vegetation and make prospecting easier. Ranchers in the Chetco Subbasin set fires every autumn to encourage growth of succulent oak mast for their hogs. Incendiary fires were frequent. Occasional lightning storms, the severely dry summers in much of the interior, and the inaccessibility of much of the area all added to the fire problem. Many of the large brushfields date from this period of widespread burning.

A changed public attitude toward forest fire prevention during the past 20 years has resulted in a decreased number of man-caused fires. Fire protection agencies have been given the financial resources necessary to maintain more adequate fire protection. Improved access and the use of air transportation for men, supplies, and fire retardent chemicals have made prompt fire suppression action possible even in the remotest areas. All of this has resulted in a decrease in burned acreage.

Some sizable fire protection and prevention problems remain. The dry summers and inflamable brush conditions are still common, and the danger of camper and logging fires has increased with more human activity.

Autumn burning to dispose of logging slash or to clear land for pasture has posed a serious fire control problem in areas protected by the Coos Forest

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1/ The above figures are estimated from data from the U. S. Forest Service's 1952 Timber Resources Review.

Protective Association. Much of the burning to create pasture was done in the early autumn, the driest part of the year on the coast. The fires sometimes escaped to burn over adjacent land. As long as this condition continued, there was little incentive for tree farming in areas that were predominantly pastured. The problem has lessened recently for several reasons; there is less clearing being done, many ranchers are using herbicides rather than burning to control brush encroachment, and there is improved rancher cooperation with the state fire protection personnel in control of permit fires.

Protection from Insect, Disease, and Animal Damage

Protection of the forests of the South Coast Basin from insect, disease, and animal damage is generally a responsibility of the individual landowners and managers. However, many owners cooperate in combatting insect, disease, and animal damage problems. Their cooperative efforts are coordinated by the Pacific Northwest Forest Pest Action Council, an organization of public and private officials. The U. S. Forest Service carries on forest insect and disease detection surveys and provides funds for pest control programs on all forest land under provision of the Cooperative Pest Control Act. The State of Oregon and private landowners share in the financing of pest control projects on private land.

The most damaging forest insect pest in the basin is the Douglas-fir bark beetle. Usually it attacks weakened trees but may breed up to epidemic proportions in logging slash or windthrown timber and then attack healthy trees.

There are several important diseases of forest trees in the basin. The Port Orford-cedar root rot (Phytophera lateralis) is gradually spreading through the area and is expected to eliminate Port Orford-cedar as a commercial timber species. The Douglas-fir root rot (Poria werii) causes losses to windthrow in mature stands and kills young trees. There are several fungous rots that cause decay in forest trees.

Many insects and diseases can be controlled by keeping forest stands healthy and promptly salvaging weakened and dying trees.

Several species of small animals feed on tree seed and seedlings. These animals are usually controlled by temporarily eradicating them from critical areas, or seed or seedlings can be made unattractive for food by treatment.

TIMBER AND WOOD PRODUCTS

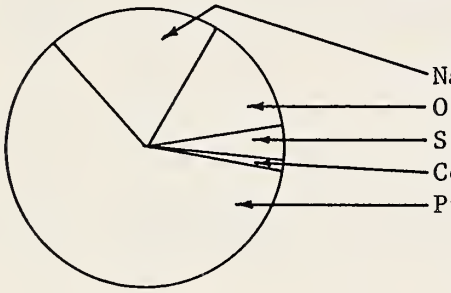
Characteristics of the Resource

About 1,566,000 acres of the South Coast Drainage Basin are suitable for production of commercial timber. This land, known as "commercial forest land", has an estimated stand of 34 billion board feet 1/ of commercial timber. Ownership of this commercial forest land and timber is shown in figure 7. Tables 4 through 7 show federal, state, and private forest landownership, and tables 8, 9, and 10 show volumes of federal and private timber.

1/ All timber volumes in this report are in terms of log scale, Scribner rule, in trees 11 inches D.B.H. and larger.

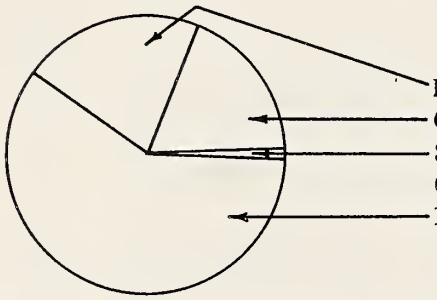
Ownership of commercial forest land and timber, South Coast Drainage Basin, Oreg., 1960

Commercial forest land



	Acres	Percent
National forest	338,300	22
Other federal (BLM)	211,000	13
State of Oregon	56,000	4
County and municipal	20,000	1
Private	940,600	60
Total	1,565,900	100

Commercial timber



	MM bd. ft.	Percent
National forest	7,640	23
Other federal (BLM) 1/	5,850	17
State of Oregon 1/	460	1
County and municipal	50	...
Private	20,000	59
Total	34,000	100

1/ Includes volume in stands older than 90 years, only.

Source: Compiled from data furnished by U. S. Forest Service, Bureau of Land Management, and State of Oregon.

Figure 7

Timber harvesting methods are somewhat modified on an estimated five percent of the publicly-owned commercial forest land. Areas where harvesting is modified include public recreation areas (other than "reserved forest land" mentioned below), roadside scenic strips, streamside protective zones, and administrative sites.

Other forest land is on such rugged terrain or is so marginally productive that it is presently uneconomical for commercial timber harvesting. There is approximately 40,300 acres of national forest land with about 460 million board feet of timber that is presently in this category and called "inoperable forest land". It is not known how much inoperable forest land is in other ownerships.

Commercial timber harvesting is excluded from about one percent of the public forest land by statuatory or administrative authority. This land is known as "reserved forest land". The national forest reserved forest land in the basin includes four areas managed in near-natural condition totalling

Table 4.--Land administered by Bureau of Land Management, South Coast Drainage Basin, Oreg., 1960

Land class and cover type	Subbasin				Total
	1. Sixes	2. Coquille	3. Coos	4. Chetco	
	Acres	Acres	Acres	Acres	Acres
Commercial forest land:					
Coniferous stands:					
Younger than 90 years	3,290	54,420	11,770	5,530	75,010
90-160 years	640	21,820	1,070	1,860	25,390
Older than 160 years	2,780	48,770	18,800	3,770	74,120
Hardwood stands	2,470	8,700	2,630	4,250	18,050
Nonstocked forest land	140	14,760	3,310	240	18,450
Noncommercial and nonforest land 1/	1,730	9,580	5,920	1,650	18,880
Total	11,050	158,050	43,500	17,300	229,900

1/ Includes military reservations and other land withheld from normal resource management.

Source: Compiled from data furnished by Bureau of Land Management.

Table 5.--National forest land and sawtimber volume, South Coast Drainage Basin, Oreg., 1961

Land class and cover type	Subbasin								Total	
	1. Sixes		2. Coquille		3. Coos		4. Chetco			
	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume
	Acres	MM Bd. Ft.	Acres	MM Bd. Ft.	Acres	MM Bd. Ft.	Acres	MM Bd. Ft.	Acres	MM Bd. Ft.
Commercial forest land:										
Virgin sawtimber types:										
Douglas-fir	44,250	1,481	26,100	1,375	...	...	97,150	3,227	167,500	6,083
Other conifers	2,550	57	4,700	117	...	...	10,100	300	17,350	474
Hardwoods	200	2	...	...	...	...	13,500	157	13,700	159
Residual sawtimber types:										
Douglas-fir	1,450	71	3,900	198	...	...	1,300	3	6,650	272
Other conifers	550	21	1,550	61	...	...	...	...	2,100	82
Hardwoods	150	...	400	1	...	...	650	7	1,200	8
Seedling-sapling and poletimber types:										
Douglas-fir	7,800	10	12,900	10	...	...	18,050	27	38,750	47
Other conifers	1,150	1	2,400	4	...	...	17,950	27	21,500	32
Hardwoods	4,550	...	...	...	...	...	10,400	...	14,950	...
Nonstocked	2,200	...	2,850	1	...	...	9,200	22	14,250	23
Inoperable forest land	4,200	85	9,450	227	...	...	26,650	148	40,300	460
Subtotal	69,050	1,728	64,250	1,994	...	...	204,950	3,918	338,250	7,640
Other land:										
Reserved forest land	...	...	1,750	86	2,700	...	77,650	814	82,100	900
Noncommercial and nonforest land	3,600	...	2,800	...	5,950	...	23,800	...	36,150	...
Subtotal	3,600	...	4,550	86	8,650	...	101,450	814	118,250	900
Total	72,650	1,728	68,800	2,080	8,650	...	306,400	4,732	456,500	8,540

Source: Compiled from data furnished by U. S. Forest Service. Volumes and areas partially estimated from forest type maps.

Table 6.--Forest land owned by the State of Oregon, South Coast Drainage Basin, Oreg., 1961 1/

Land class and cover type	Subbasin 1 Sixes	Subbasin 2 Coquille	Subbasin 3 Coos	Subbasin 4 Chetco	Total
	Acres	Acres	Acres	Acres	Acres
Commercial forest land:					
Old-growth Douglas-fir	300	...	2,600	600	3,500
Large coniferous sawtimber	100	...	3,800	100	4,000
Small coniferous sawtimber	50	100	40,820	...	40,970
Coniferous poletimber	70	150	1,000	...	1,220
Coniferous seedlings and saplings	100	...	1,000	50	1,150
Hardwoods	100	...	4,730	200	5,030
Nonstocked forest land	...	...	110	...	110
Noncommercial and nonforest land	130	...	240	100	470
Total	850	250	54,300	1,050	56,450

1/ Does not include forest land in state parks and reservations.

Source: Estimated from data furnished by the State of Oregon.

Table 7.--Private forest land, South Coast Drainage Basin, Oreg., 1961

Land class and cover type	Subbasin 1 Sixes	Subbasin 2 Coquille	Subbasin 3 Coos	Subbasin 4 Chetco	Total
	Acres	Acres	Acres	Acres	Acres
Commercial forest land:					
Sawtimber stands:					
Coniferous	42,500	77,000	73,000	27,500	220,000
Hardwood	2,000	9,000	7,500	2,500	21,000
Poletimber stands:					
Coniferous	19,000	36,500	34,500	12,000	102,000
Hardwood	3,000	12,500	10,000	4,500	30,000
Seedling-sapling stands:					
Coniferous	10,000	67,000	50,500	5,000	132,500
Hardwood	3,500	31,000	24,500	5,000	64,000
Nonstocked	12,000	19,000	15,000	8,500	54,500
Logged 1949-1960, stocking unknown	65,800	122,500	81,850	46,450	316,600
Noncommercial forest land	1,000	1,000	1,000	500	3,500
Total	158,800	375,500	297,850	111,950	944,100

Source: Estimated from data furnished by Pacific Northwest Forest and Range Experiment Station, U. S. Forest Service, State of Oregon, and County Assesors, Coos, Curry, and Douglas Counties, Oregon.

Table 8.--National forest timber volumes by species 1/, South Coast Drainage Basin, Oreg., 1961

Species	Subbasin 1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
Douglas-fir	1,461	1,485	...	3,133	6,079
Redwood	...	...	...	187	187
Ponderosa pine and sugar pine	36	37	...	100	173
Other pine species	3	5	...	24	32
True firs	3	1	...	18	22
Western hemlock	42	90	...	2	134
Port Orford-cedar	60	128	...	19	207
Other coniferous species	1	7	...	13	21
Hardwoods	37	14	...	274	325
Total	1,643	1,767	...	3,770	7,180

1/ Millions of board feet in all stands on operable commercial forest land.

Source: Estimated from U. S. Forest Service timber resource inventory data.

Table 9.--Volume by species 1/, land administered by Bureau of Land Management, South Coast Drainage Basin, Oreg., 1961

Species	Subbasin 1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
Douglas-fir	107	3,815	1,228	182	5,332
True firs	1	42	6	2	51
Western hemlock	1	238	70	2	311
Port Orford-cedar	1	40	1	4	46
Other coniferous species	...	85	25	...	110
Hardwoods	2/	2/	2/	2/	2/
Total	110	4,220	1,330	190	5,850

1/ Millions of board feet in stands older than 90 years on commercial forest land.
2/ No estimate available.

Source: Estimated from data furnished by Bureau of Land Management.

82,100 acres. The four areas include the 77,650 acre Kalmiopsis Wild Area in the Chetco Subbasin and the 2,700 acre Umpqua Dunes Scenic Area in the Coos Subbasin, both of which are managed primarily for recreation, and the Coquille River Falls and Port Orford-cedar Natural Areas in the Coquille Subbasin totalling 1,750 acres, both of which are used primarily for scientific observation and research. Other reserved forest land includes 3,400 acres

Table 10.--Estimated sawtimber volume 1/ on private land, South Coast Drainage Basin, Oreg., 1961

	Subbasin				
	1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
1948 sawtimber volume	4,000	11,100	8,800	2,800	26,700
Estimated net growth 1949-1960	750	1,350	1,450	450	4,000
Estimated harvest 1949-1960	2,150	4,250	2,800	1,500	10,700
Remaining volume 1961	2,600	8,200	7,450	1,750	20,000

1/ Millions of board feet, all species.

Source: Estimated from data furnished by Pacific Northwest Forest and Range Experiment Station, U. S. Forest Service.

of BLM lands formally withdrawn for recreational development, state parks, and county parks. Commercial timber harvesting is also excluded from some of the private forest land for a variety of reasons.

About 81,200 acres of forest land are not capable of producing commercial timber. This "noncommercial forest land" consists of areas of very low productivity. Part of the "reserved forest land" is also "noncommercial forest land".

The site quality of the commercial forest land is quite variable. The preliminary draft of a Soil Conservation Service soil survey report covering the coastal portion of Curry County indicates that deep, medium-textured soils in that area have an average site index of 170 to 190 1/ while light-textured soils have an average site index of 140. Areas of intrusive rock, usually found as large mounds on hills in this area, are characterized by shallow, medium-textured soils with an average site index of 110. The interior of the Coos and Coquille Subbasins are probably the best timber growing areas with site quality decreasing generally toward the south and east. For instance, the Bureau of Land Management reports its land in the Coos and central Coquille River watersheds has an average site index of about 170 while its land in the headwaters of the Middle Fork of the Coquille River has an average site index of about 140. National forest land in the Coquille and Sixes Subbasins has an average site index of about 130. The best sites are in the well drained river bottoms and on north slopes while rocky areas on south slopes are the least productive. Site quality is somewhat lower in the interior of the Chetco Subbasin averaging about 130 for Bureau of Land Management land in the North Fork of the Chetco River and 115 for national forest land.

About one-third of the commercial forest land supports stands of timber that are more than 160 years old. The majority of these stands are relatively slow growing and are quite susceptible to insect and disease attack. One of the objectives of forest management is an orderly harvesting of these stands

1/ Average height of dominant and codominant Douglas-fir at age 100 years.

and systematic replacement of them with a young, fast growing crop of trees. This conversion from a wild to a managed forest condition is progressing rapidly, but progress should be slow enough to insure a constant supply of raw material for the wood-using industry while the young stands are growing to merchantable size. The presence of large areas of young growth stands in the South Coast Basin is due to early-day logging and fires.

Logging and Wood-Using Industries

Early-day logging in the South Coast Basin was mostly along the coast and in the main river valleys because of limitations in logging equipment, transportation facilities, and markets for forest products. High grade lumber and cedar shakes and shingles were the only readily marketable forest products, so only high quality logs from accessible stands were considered merchantable. Much of the early-day logging was on lands now used for agriculture.

The logging and wood-using industries have been expanded rapidly during the past 40 years. Improved logging equipment suitable for use on rugged terrain, improved road building equipment, and truck transportation have made most of the area accessible to logging. The forest products industry has become greatly diversified to include plywood, hardboard, and paper as well as lumber production (tables 11 and 12). Better rail, highway, and water transportation have greatly improved the marketability of forest products. This has all strengthened the position of the forest industries as a stable, continuing enterprise.

On the basis of 260 eight-hour shifts per year, the present installed sawmill capacity requires a timber supply of about 930 million board feet per year. Plywood and veneer plants require an additional 500 million board feet on the basis of industry-wide production efficiency to operate at full capacity. The total annual timber requirement for these industries is more than 1.4 billion board feet. This may be somewhat more than the potential timber growth, and it is probably far more than the present timber growth in the South Coast Basin.

The trends in timber harvest and lumber production in Coos and Curry Counties are shown in figure 8. Note that only a small part of the timber harvest has been from public land. There was little demand for public timber until about 1950 because of an abundance of accessible, high quality private timber. As the private timber became less plentiful, the demand for public timber steadily increased. Expensive road construction, problems in procurement of rights-of-way across private land, and a shortage of access road construction funds delayed the opening of federal lands to timber harvest. However, the allowable cut was achieved by about 1958, though somewhat earlier for some national forest and BLM lands. Harvesting in the Elliot State Forest began in 1958 and has increased steadily since then. Most of the merchantable stands of the Elliot State Forest are located in the Umpqua Basin, and timber harvesting is being concentrated in that area. Few of the county-owned commercial forest stands are of merchantable size, so the present timber harvest is quite low.

Lumber production has consistently been less than log production in recent years probably because of increasing use of logs for plywood and pulp and increasing log shipments to other areas for manufacture. In 1960, log

Table 11.--Wood-using industrial establishments, South Coast Drainage Basin, Oreg., 1959

Product	Subbasin 1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
	Number	Number	Number	Number	Number
Primary products:					
Lumber	12	38	27	24	101
Plywood, veneer	2	6	4	5	17
Shingles	...	2	1	...	3
Remanufactured products	...	...	4	...	4
Wood residue products:					
Pulp	...	...	2	...	2
Hardboard	...	...	1	...	1
Particle board	...	...	1	...	1
Specialty products:					
Myrtlewood novelties	6	8	6	7	27

Table 12.--Installed production capacity of certain wood-using industries, South Coast Drainage Basin, Oreg., 1959

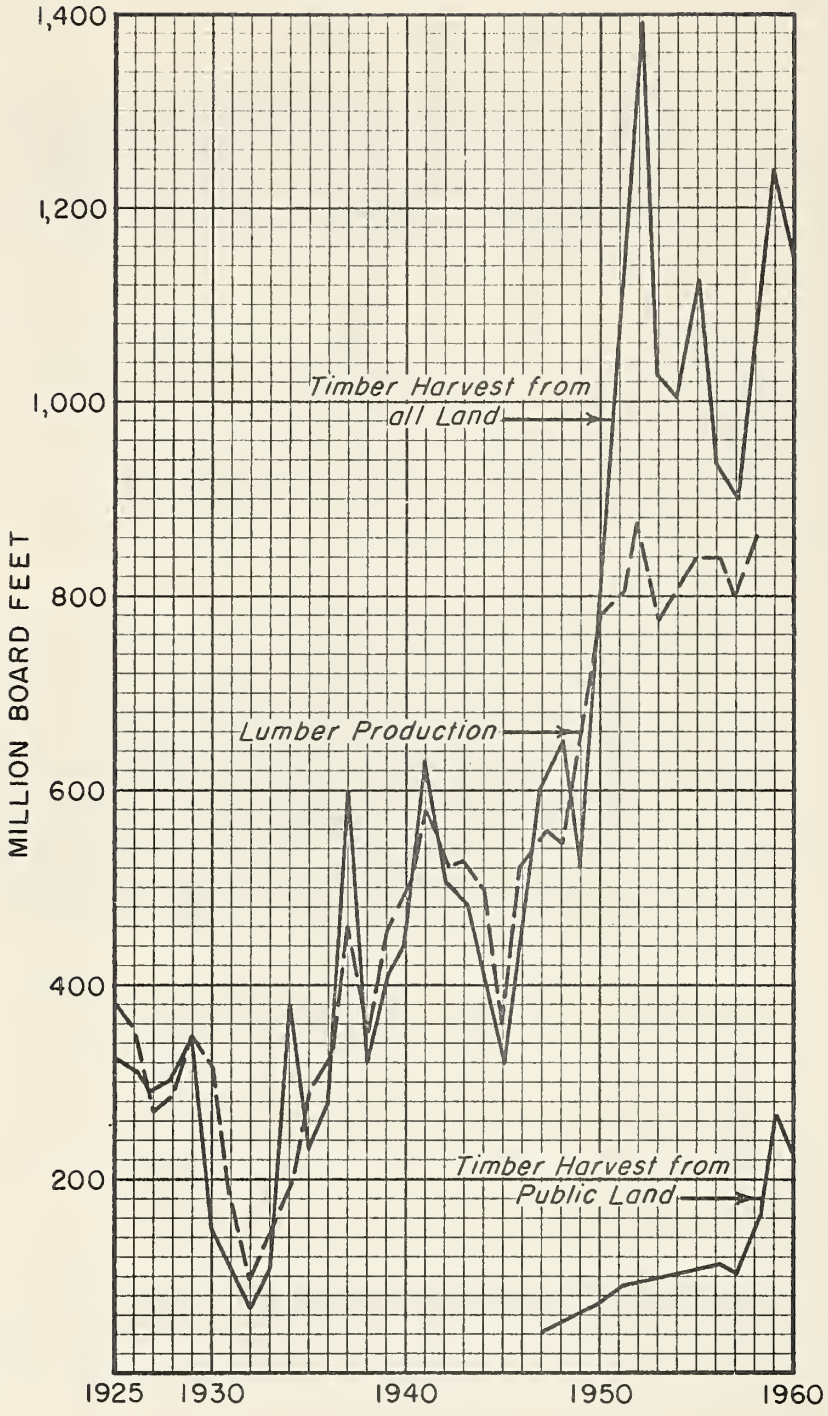
Product and unit of measurement	Subbasin 1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
Lumber, M bd. ft./8 hr. shift	354	780	1,900	560	3,585 1/
Plywood and veneer, million sq. ft./mo. 3/	10	45	30	15	100 2/
Hardboard, million sq. ft./yr. 3/	...	...	27	...	27
Particle board, million sq. ft./yr. 3/	...	...	12	...	12
Wood pulp, tons/24 hrs.	...	...	215	...	215
Paper, tons/24 hrs.	...	...	125	...	125

1/ Production capacity information available for only 47 of the 101 sawmills in the basin. The other 54 mills are small and operate intermittently. Their total production is probably less than 10 percent of the basin total.

2/ No estimate available for 2 veneer plants.

3/ Three-eighths inch basis.

Sources: Handbook and Directory of the Forest Industries, Miller-Freeman Publications, Inc., Portland, Oreg., 1960. Crow's Buyer's and Seller's Guide of the Western Lumber and Plywood Industries, C. C. Crow Publications, Inc., Portland, Oreg., 1960. Lockwood's Directory of the Paper and Allied Trades, Lockwood Trade Journal Co., Inc., New York, 1960.



Sources: U.S. Forest Service, Pacific Northwest Forest and Range Experiment Station, and West Coast Lumbermen's Association.

1/ Includes volume removed as logs, but not volume removed for poles, piling and woodcutting operations. Includes volume from live and dead trees.

Figure 8: Timber harvest 1/ and lumber production, Coos and Curry Counties, Oregon, 1925-1960

shipments from the Port of Coos Bay to foreign ports totaled more than 66 million board feet, most of which was Port Orford-cedar. 1/ Logs are also shipped to the interior of the state and to California for manufacture. A smaller volume is brought into the Coos Bay area for manufacture, notably from western Lane and Douglas Counties.

The forest industries are very important to the economy of the basin. For instance, more than 90 percent of the 8,500 people employed in manufacturing in Coos and Curry Counties in 1958 were engaged in some form of logging and wood products work. This does not include persons employed in particle board and pulp and paper manufacture. The total 1958 payroll from the logging and wood products industries was about 40 million dollars. Another measure of the economic importance of the forest industries is the value of their various products. The stumpage value of timber harvested in Coos and Curry Counties in 1958 was an estimated 22 million dollars. Logging and transportation to manufacturing points added an estimated 20 million dollars to the log value. Manufacturing into lumber, plywood, and other wood products (not including particle board, pulp, and paper) added an estimated 50 million dollars to the product value.

Forest products are shipped to domestic and foreign markets. For instance, lumber shipments from the ports of Coos Bay, Bandon, Port Orford, Gold Beach, and Brookings totaled 722 million board feet in 1960 of which one-half went to West Coast ports, principally to California, one-fourth to Atlantic Coast ports, and one-fourth to foreign ports. 2/ Plywood, piling, wood pulp, and paper are also shipped from Coos Bay via water transportation. Lesser amounts of forest products are shipped via rail and truck.

While wood utilization has improved greatly, there is still a very large amount of unused wood residue from lumber and plywood manufacture (table 13). Some of the residue that is presently used for fuel could be manufactured into secondary wood products. There is also a very large volume of sound wood in logs that are left in the woods because they are presently considered unmerchantable because of size, species, or defect. Markets for hardwood species are limited to some use of alder for pulp in the Coos Bay area, myrtlewood for specialty woodworking, and high quality logs of other species for veneer in the Brookings area. Better wood utilization depends on a number of factors not all of which are within the control of a single producer or industry. They include:

1. Development of new products. Not all of the unused wood is suitable for presently-known products.

2. Expansion of markets for secondary wood products. Plant capacity for some of these products is already overexpanded nationally.

3. Costs of raw material, labor, transportation of finished product, etc. compared to costs in other areas.

4. Cost of disposal of effluent.

1/ Source: Port Commission, the Port of Coos Bay.
2/ Source: Ibid.

Table 13.--Production and disposition of wood residues from sawmills, veneer plants, and plywood plants, Coos and Curry Counties, Oreg., 1953

Source and type of residue	Production	Disposal			
		Fuel 4/	Remanufacture	Unknown	Not used
	M tons 1/	M tons	M tons	M tons	M tons
Sawmills 2/:					
Solid material	426	162	31	...	233
Sawdust	272	160	...	...	112
Shavings	199	47	...	...	152
Bark	276	...	...	276	...
Plywood and veneer plants 3/:					
Cores	15	1	10	...	4
Veneer trim	42	15	...	...	27
Roundup, log trim, spur trim	24	...	...	...	24
Dry end residue	41	...	...	...	41
Bark	39	...	...	39	...
Total	1,334	385	41	315	593 5/

1/ Dry weight.
2/ 1953 lumber production was 850 million board feet.
3/ 1953 plywood or equivalent veneer production was 310 million square feet, 3/8 inch basis.
4/ Includes fuel sold and fuel used by the mill.
5/ One 125 ton daily capacity pulp mill has been installed in the Coos Bay area since this study was made.

Source: Oregon Forest Products Laboratory, Corvallis, Oregon.

5. Availability of sufficient quantities of pure water. Water requirements are particularly high for pulp manufacture, though most of the water is not consumed. Water can be reused in several of the board manufacturing processes.

The entire South Coast Basin has favorable supplies of unused wood for secondary manufacturing. Water supplies are probably sufficient for a sizable industry in the Coos Subbasin but are more critical elsewhere. Satisfactory disposal of effluent from manufacturing processes would be a problem in all areas.

Harvesting and Regeneration Methods

Clearcutting in blocks of 20 acres or more is the most widespread harvesting practice in the old-growth timber stands of the South Coast Basin (fig. 9). This method is well suited to the evenaged stand structure and the steep topography. Cable harvesting methods are best suited to the steep terrain and usually result in less soil disturbance than tractor skidding.

Logs are generally hauled out of the woods by truck. In many instances they are dumped at railhead and reloaded for rail transportation to the mill

Figure 9 Block clearcutting methods were used in harvesting old-growth Douglas-fir on Mt. Emily, Chetco Subbasin.

or dumped at tidewater and rafted for towing to the mill. Truck roads are expensive and difficult to construct, and if improperly located or constructed can be a major source of soil disturbance, especially in areas of critical soil stability.

As mentioned previously, a large amount of presently unmerchantable wood is left on the cutover areas. This slash forms a serious fire hazard and impedes re-establishment of desired tree species. Broadcast burning is the usual method of disposal of this slash. Hot slash burns may reduce soil productivity, increase the erosion hazard, and make regeneration difficult by changing the ecology of the site. Very light burns often do not result in sufficient fire hazard reduction or a satisfactory environment for regeneration. On steep terrain much of the slash accumulates in the draws and canyons. If this slash is not removed before the winter high water period, it may be carried downstream to form log jams which promote streambank erosion, block fish migration, or break loose in flash floods to endanger life and property downstream.

The coastal climate is generally favorable for rapid regeneration of cutover land. Natural regeneration is often adequate near the coast and in the interior of the Coos and Coquille Subbasins except on dry southerly exposures, provided cutting areas are small enough that there is a nearby seed

source. Planting of nursery-raised seedlings and direct seeding are common methods of supplementing natural regeneration. If a stand of seedlings is not promptly established, cutover areas soon become covered with a mass of dense hardwood growth, and restocking with desirable species may be delayed for several years. Seedling and sapling stands sometimes require release from brush competition. Young growth stands may suffer extensive damage from fire, livestock, big game, and small animals such as the mountain beaver.

Serious regeneration problems are common in the Chetco Subbasin due to deficient soil moisture during the summer and very severe brush competition. There are also many brushfields, which became established after early-day fires, that need to be converted to timber production.

Harvesting and regeneration practices vary somewhat with ownership. The public lands are managed on a sustained yield basis. Logging, road construction, and regeneration methods are used which will maintain soil productivity and protect watershed values.

As forestry becomes a more profitable enterprise, private owners are adopting better forest management practices. Management on some of the more progressive private holdings is probably at least equal to that on public land. Generally, but with some exceptions, the large private ownerships which total about 440,000 acres are among the better managed lands. However, even on many of these ownerships there is some disregard of accepted watershed management practices which may not provide a direct profit.

Many of the private ownerships are too small to be operated as full-time forest enterprises, and many of the owners are only casually interested in tree farming. Consequently, many of the small ownerships are poorly managed. Cutting areas tend to be large, and there is less concern about establishment of a new timber crop. Roads are often very poorly constructed since small tracts of timber will not justify a permanent system. Logging operations are often poorly planned and executed.

Conversion of cutover land to sheep pasture is still widespread among ranch owners. The usual practice is to burn the logging slash and seed the area to grass. However, as forestry becomes a more profitable enterprise, there is a tendency for this land to be allowed to revert back to forest (fig. 10). Further discussion of this and other forest land management problems is in the "Problems" section of this report.

Sustained Yield Potential

The large timber volume being harvested from the South Coast Basin is rapidly depleting the old-growth reserve. At the present rate of harvest, the old-growth timber on private land may be completely harvested within 30 years, and the old-growth timber on public land will be completely harvested within 80 years. Thereafter, the basin's timber harvest will have to come from the second-growth stands. The long-term sustained yield of the area's forests will depend on several factors including:

1. Natural site quality of the forest land.

2. Promptness and adequacy of regeneration on cutover land.

Figure 10 Nine year old Douglas-fir seedlings are well established on this formerly-pastured area near Gold Beach.

3. Adequacy of protection from fire, insect, disease, and animal damage.

4. Cultural treatment applied to the young stands. Timely thinning of stands to remove dead, dying, and undesirable trees and to give the desirable trees more growing room can increase the quality and quantity of wood production. The economic possibility for thinning depends largely upon the availability of markets for small logs.

5. Maintenance of optimum stocking throughout the life of the stand.

6. Age at which final harvest is made.

7. Availability of markets for wood that is not presently merchantable.

8. The amount of forest land that is converted to and from other uses.

Public Lands. The timber resources of federal and state lands have

Table 14.--Allowable annual timber cut 1/, 1961, and actual timber harvest 1/, 1956-1960, federal and state-owned commercial forest land, South Coast Drainage Basin, Oreg.

Ownership class	Subbasin 1 Sixes	2 Coquille	3 Coos	4 Chetco	Total	Av. annual harvest 1956-60
National forest 2/	22	20	...	39	81	85
Bureau of Land Management 3/	2	83	21	4	110	87
State of Oregon 4/	...	...	14	...	14	8
Total	24	103	35	43	205	180

1/ Millions of board feet, Scribner rule, 32 foot logs in trees 11 inch D.B.H. and larger.

2/ The present national forest allowable cut was established January 1, 1961. The previous allowable cut was about 75 million board feet.

3/ Reflects resurveys completed during 1959 and 1960. The previous allowable cut was about 90 million board feet.

4/ No timber cutting before 1958.

Source: Data furnished by U. S. Forest Service, Bureau of Land Management, and State of Oregon.

been inventoried within the past 5 years. The volume of timber that could be harvested annually within the ensuing 10 years without impairment of the productivity of these lands was determined from the inventory data. This volume is known as the "allowable annual cut" (table 14). The administrative policy of the public agencies is to offer for sale each year a timber volume equal to the allowable cut. This assures a continuous uniform harvest of timber from the public lands. The timber resource is reinventoried at approximately 10 year intervals, and allowable cuts are recalculated for the ensuing 10 year period. These recalculations consider such factors as improvement in wood utilization, rapidity of regeneration of cutover land, and changes in management techniques and policies.

Management of a large portion of the public lands is still quite extensive. For instance, a lack of access roads prevents salvage of much of the annual losses to fire, insects, and diseases. An estimated 25,000 acres of older burned areas have either not restocked or are stocked with undesirable brush species. Much of the land is stocked with decadent old-growth stands. While these stands contain most of the area's timber volume, they are growing very slowly, if at all, and are highly susceptible to insect and disease attack. A long-term timber management objective is to harvest these stands at a rate that will result in sustained timber harvest until the young-growth stands reach maturity. It is also important to establish a balanced stand age structure--that is, to have the timber producing area about equally divided among stands of each age class up to the established rotation age. It will be near 80 years before the conversion from old-growth to young-growth stands is completed. As this conversion takes place, there will be a steady increase in acreage of young, rapidly growing stands, and more intensive management will be needed. If additional public land were reserved from timber harvesting by statuatory or administrative authority, reduced harvests

would result.

The long-term sustained yield will be largely determined by the growth rate realized in the balanced stand age structure of the future. The sustained yield can be roughly estimated on the basis of site quality and land area (table 15). The national forest land located in mountainous interior areas with rugged topography, shallow soils, and relatively dry summers will probably have the lowest sustained yield per acre. Lands administered by the Bureau of Land Management are of better site quality, so their sustained yield will tend to be higher. Land in Elliot State Forest in the Coos Subbasin has a high site quality and is mostly stocked with fast-growing young stands. The long-term sustained yield of timber from the Elliot State Forest will be high, but actual timber harvest will be comparatively small until the second-growth stands reach maturity. The county-owned forest land is also of high site quality. However, it will be many years before much timber can be harvested from the present immature stands on this land.

Table 15.--Estimated ultimate sustained yield of timber 1/, by ownership, South Coast Drainage Basin, Oreg.

Ownership class	Subbasin 1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
National forest	32	27	...	58	117
Bureau of Land Management	4	110	35	6	155
State of Oregon	...	...	29	...	29
County and municipal	...	10	10	...	20
Private	120	350	270	60	800
Total	156	497	344	124	1,121

1/ Millions of board feet, Scribner rule, 32 foot logs in trees 11 inches D.B.H. and larger.

Source: Estimated from data furnished by U. S. Forest Service, Bureau of Land Management, and State of Oregon. Site index and acreage data were provided by the agencies concerned. Average rotation age was set at the point of culmination of mean annual increment. Stocking was assumed to be 80 percent of normal, and it was assumed that thinnings would be harvested from 50 percent of the acreage. Yield data was from The Yield of Douglas-fir in the Pacific Northwest by R. E. McArdle and Walter H. Meyer (USDA Technical Bulletin 201).

Private Land. The most recent inventory of all of the private timber resources of the basin was completed in 1949. It is not possible to state an allowable annual cut for private land because of the wide variation in management objectives among various owners.

The old-growth timber stand on private land is being rapidly depleted. In 1949, there were an estimated 26.7 billion board feet of timber and 500,000 acres of sawtimber stands on private land in the South Coast Basin. Between 1949 and 1960, an estimated 10.7 billion board feet was cut from 316,600 acres

of initial cutting and 160,000 acres of relogging (tables 7 and 10). Much of the initial cutting consisted of clearcut harvest cuttings. During this same period timber growth was an estimated 4 billion board feet. If these rates of harvest and growth were continued, the private timber would be exhausted in about 30 years.

The private forest land is of generally high site quality, the average site index varying from about 130 to 170. Under intensive management this land would probaly have a sustained yield of about 800 million board feet of timber annually (table 15). However, the present board foot growth rate is less than half of this because the existing forest stands are mostly either very slow-growing old-growth or young-growth that is below merchantable size. In addition, a large acreage is either poorly stocked or stocked with undesirable species.

Much of the private land is suitable for profitable intensive forest management, being of good site quality, on relatively gentle terrain, and accessible to diversified markets for wood. However, some of the land is on rugged terrain of poorer site quality so will probably be managed less intensively, and the yield of timber from this land will be relatively small.

It is not known how much private forest land is, or will be, used for purposes other than timber growing or how much land now used for agriculture may be converted to timber production.

Without an up-to-date inventory of private forest land it is impossible to know the type of management that is now being practiced on recently logged land. It is very important that this land be promptly restocked with desirable species if the land is to produce its optimum timber growth in the near future. On the better quality land where regeneration is prompt and adequate, a mature crop can be harvested within 80 to 90 years, and some sawlogs can be harvested in thinnings within 40 years. Many of the present poletimber stands will probably be ready for harvest within 40 years.

In the past, most of the timber supply for the forest industries has come from private land. It appears that the timber harvest from private land may be curtailed when the old-growth timber is all harvested. However, as the young-growth stands grow to maturity, the timber harvest may be expected to again increase to about the sustained yield potential estimated in table 15. Meanwhile, the effects of a temporarily smaller timber harvest on the basin's economy could be somewhat offset by further diversification of the forest products industry to more complete utilization of the available raw material supply.

Other Forest Products

Several forest products other than timber are harvested from the South Coast Basin. Most of these products can be harvested without reducing the productivity of the timber stands. Their harvesting and processing is an important source of employment, particularly in rural areas. They can provide income for landowners who are waiting for their young timber stands to reach maturity and thus make forest land management a more profitable venture.

More than 45,000 Christmas trees with a stumpage value of about $20,000

and a retail value of about $180,000 were harvested from Coos and Curry Counties in 1959. Christmas trees are harvested as an early crop from stands being grown for sawtimber and as a primary crop on some relatively infertile sandy soils along the coast. Trees are also harvested from federal land through commercial sale or individual permit.

Florist greens including sword fern, evergreen huckleberry, cedar boughs, and salal are harvested from much of the area. Landowners usually lease collecting rights to pickers on an annual basis. On public forest land the picker pays for the actual amount collected. Conservation harvesting practices are necessary to assure the wise and continuous use of these products.

Several minor wood products including fuelwood, fence posts, and shakebolts can be cut from logs or trees that are not merchantable for sawtimber. Port Orford-cedar, which is native only to southwest Oregon, is valued as a source of arrow stock. There is a limited market for high quality Oregon-myrtle logs and burls with a distinctive grain pattern.

There are several other forest products of minor commercial value including tree seed cones, crude drug materials, and wild fruits and berries.

RANGE

The dense forests of the South Coast Drainage Basin with their thick undergrowth do not produce much forage for grazing animals. Naturally created grassy open areas, locally known as "prairies", occur at scattered locations through the forested interior of Coos and Curry Counties and are used for grazing. These prairies are due to soil conditions that are toxic to tree growth or are a result of early-day fires. The permitted national forest grazing including 400 animal unit months of use by cattle in the Chetco Subbasin and 96 animal unit months in the Coquille Subbasin is mostly on fire-cause prairies. With effective fire protection the prairies are gradually being invaded by trees and brush, so a steady decline in their forage production may be expected.

Many acres of high quality cutover forest land are used for grazing. The intensity of use varies from the grazing of goats on brushy cutover land to outright conversion of cutover areas to sheep pasture. The extent of these practices and the problems connected with them is discussed elsewhere in this report.

WILDLIFE

The wildlife and sports fishery resources of the South Coast Drainage Basin are managed by the Oregon State Game Commission. The commercial fishery is managed by the Fish Commission of Oregon. The wildlife habitat is controlled by the individual landowners and the administrators of public lands. Wildlife populations are very strongly influenced by habitat conditions. The original dense forests of the basin did not provide a favorable habitat for many species, so wildlife populations were relatively small. Clearing of land for agriculture and logging of timber stands with subsequent regeneration of young trees and brush have provided a more favorable habitat for some species such as deer and elk. These species have increased in numbers despite heavy hunting pressure in some instances. Man-made environmental

changes have caused the population of other species to decrease. Although production of wildlife on forest land is generally compatible with other uses of this land, conflicts do occur.

Big Game

The most numerous big game species is the western blacktailed deer. Populations tend to increase rapidly on cutover forest land. Hunting pressure is quite heavy in Coos County but is light in Curry County because of poorer access to hunting areas. The average hunter success in the two counties is about 65 percent, well above the average for western Oregon. Hunting pressure will probably increase as more roads are extended into the interior of the basin.

Roosevelt elk herds are most common in Coos, western Douglas, and northern Curry Counties. Few elk are found in the Chetco Subbasin. The elk harvest in Coos and western Douglas Counties in 1959 totaled 938 bulls, about 50 percent of the total harvest in western Oregon. Elk populations have increased recently.

Black bear is classified as a game animal by the Game Commission, but there is no closed season for this species in this area. The bear population has decreased under heavy hunting pressure.

Deer and elk herds show little tendency toward seasonal migrations in this area, except in the high mountains. There the summer and winter ranges are seldom more than a few miles apart. The animals tend to congregate near cutover areas where food is fairly plentiful. Heavy use of cutover areas by big game may result in damage to young trees from browsing and trampling. This conflict between big game management and timber production is best solved by keeping big game populations at levels compatible with the available food supply. Special hunting seasons are sometimes necessary to control big game populations. However, special seasons are not effective unless hunters can be enticed into hunting in the particular areas where problems exist.

Small Game

There are several small game species represented in the South Coast Basin. The more important species include valley and mountain quail, blue and ruffed grouse, band-tailed pigeons, mourning doves, and brush rabbits. All are hunted to some extent.

Although not abundant, beaver, muskrat, mink, racoon, and otter are the most common furbearing species.

The waterfowl population consists mainly of migrants, although the basin is somewhat west of the main migration route. Waterfowl are most commonly found on the bays, lakes, and estuaries adjacent to the coast.

Bobcat and coyote are the most numerous predator species; cougar are less numerous. These predators occasionally attack domestic livestock, particularly in Curry County.

Several species of small mammals including mountain-beaver, pocket

gophers, ground squirrels, chipmunks, field mice, and rabbits feed on tree seed and seedlings and may seriously hamper regeneration in some areas.

Anadromous Fish

There are runs of chinook salmon, silver salmon, and steelhead trout in most of the principal streams of the basin. Other anadromous species include sea-run cutthroat trout, shad, striped bass, and sturgeon. Migration and spawning habits vary with each species, so that there are migrants of at least one species in the rivers at any given season.

Anadromous fish populations are much smaller than they were when the area was first settled for several reasons. Commercial fishing was permitted on several coastal streams for many years. Man-created barriers such as small dams and log jams blocked access to many spawning areas. Hydraulic mining and road construction destroyed sizable spawning areas. Siltation and pollution made streams a less favorable habitat for fish.

Sport fishing for anadromous species in the streams, bays, and offshore areas is of considerable economic importance. For instance, between 1956 and 1958 an average of 76,500 sports angler trips were made annually to the basin (including adjacent ocean waters) to catch 18,500 salmon and 6,800 steelhead.

Native Fish

Cutthroat and rainbow trout are in most of the principal streams of the basin. They do not attain large size because most of the streams lack an abundant food supply. These and warm water species such as large-mouth bass are in the coastal lakes. Lake fishing is a very popular recreational activity in the area.

RECREATION

Pattern of Use

Recreational use of the South Coast Drainage Basin is heavily concentrated along the immediate coast where the chief attractions are the ocean, sand dunes, several fresh water lakes, and a cool summer climate. Much of the public forest land in this area is used for recreational purposes as national forest recreation areas and state and county parks. A 2,700 acre portion of the Siuslaw National Forest north of Coos Bay is in the Umpqua Dunes Scenic Area, a national forest recreation area managed in near-natural condition. Many of the forest stands along the coast are of relatively low commercial value for timber, but their thick, bushy growth provides shelter from the strong coastal breezes making them an ideal location for campgrounds and picnic areas. Much of the private forest land in this area is used for recreational purposes, for summer home sites, resorts, trailer parks, and related uses. The most common outdoor recreational activities in the coastal area are salt water and lake fishing, "sand dune riding" (touring through the sand dune areas in "beach buggies"), beachcombing, sightseeing, and camping and picnicking to escape the summer heat of the interior valleys.

Recreational use of the forested interior of the basin has been very light until recently because of poor access. As timber access roads have

been extended into this area, recreational use has increased quite rapidly. The public lands are open to recreational use, and there are national forest and Bureau of Land Management camp and picnic grounds as well as state and county parks on these lands. The 77,650 acre Kalmiopsis Wild Area in the Chetco Subbasin is a national forest recreation area managed in near-natural condition to provide a retreat from civilization, preserve the flora and fauna, and afford opportunities for inspiration, enjoyment, and scientific study. Private landowners particularly the large industrial owners are allowing more public recreational use of their land largely because of a much more responsible public attitude toward forest fire prevention and the need for increased public recognition of private forest management. The summer recreational use of the interior is mainly for sightseeing, camping and picnicking, and fishing. Many of the visitors are residents of the coastal area who come inland to escape the cool, windy, foggy weather. Autumn recreational visits are primarily for deer and elk hunting, which have become much more popular because of improved access and the abundance of game in clearcut openings in the forests. Winter recreational use is mostly confined to fishing for anadromous species in the rivers.

The most comprehensive statistics of recreational use in this area are those for the national forests presented in tables 16 and 17. These indicate the general pattern of use and illustrate the sharp upward trend in use during the past five years. It is estimated that there will be about 20 times as many recreational visits to the national forests of the basin in the year 2000 as there were in 1960. The economic benefits of increased recreational use of the basin may help to offset the effect of decreased activity in the logging and wood-using industries. An increased acreage of private forest land will be used for summer home development and other intensive recreational uses in the future, and forest land in general will be increasingly visited by recreationists.

Public Recreational Facilities

The developed recreational facilities of the South Coast Basin consist of national forest camps, state parks, county parks, and parks maintained by industrial timberland owners. There are fees charged for use of some state park facilities while other facilities are free.

The national forest facilities consist of 13 campgrounds with a total of 165 family units (a family unit consists of a fireplace, table, and cleared campsite). One campground with 95 family units is adjacent to the sand dunes area in the Coos Subbasin. Other smaller campgrounds are located inland in the Siskiyou National Forest.

There is one campground on land administered by the Bureau of Land Management, and 3,400 acres of BLM land are formally set aside for recreational purposes. There are 29 state parks with facilities for picnicking and overnight camping. Most of the 11 county parks are intended only for day use.

A recent development has been construction of public recreational facilities by some of the industrial timberland owners. Usually these are constructed and maintained in cooperation with the local county park department.

The present facilities are no more than adequate to meet present needs,

Table 16.--Recreational use of the national forests by primary purpose of visit, South Coast Drainage Basin, Oreg., 1956-1960

Purpose of visit	Year				
	1956	1957	1958	1959	1960
	Visits	Visits	Visits	Visits	Visits
Camping	12,320	13,400	15,080	15,310	16,170
Picnicking	9,370	9,590	11,230	11,970	12,440
Swimming	450	460	670	720	1,150
Hunting	1,230	3,480	4,760	5,260	5,520
Fishing	1,200	3,700	4,750	4,960	5,580
Hiking and riding	30	130	230	430	530
Boating	...	...	...	200	...
Wilderness travel	50	120	170	200	250
Other 1/	12,330	12,940	13,890	15,460	17,080
Total	36,980	43,820	50,780	54,510	58,720

1/ Most of these visits are for the purpose of beachcombing and "sand dune riding" in the Coos Subbasin.

Source: Estimated from data furnished by U. S. Forest Service.

Table 17.--Recreational use of the national forests by subbasin, South Coast Drainage Basin, Oreg., 1956-1960

Subbasin	Year				
	1956	1957	1958	1959	1960
	Visits	Visits	Visits	Visits	Visits
1. Sixes	950	1,550	2,370	2,940	3,380
2. Coquille	2,370	6,590	8,770	9,450	10,420
3. Coos	33,200	34,950	37,650	39,150	40,700
4. Chetco	460	730	1,990	2,970	4,220
Total	36,980	43,820	50,780	54,510	58,720

Source: Estimated from data furnished by U. S. Forest Service.

and all of the public agencies mentioned above plan to provide increased facilities as needed to meet the future demand. For example, it is estimated that the U. S. Forest Service has campground sites available for development with a potential total capacity of about 15 times the capacity of the present facilities. Extensive national forest recreational development is possible in the coastal area north of Coos Bay and in the South Fork Coquille River, Elk River, Chetco River, and Winchuck River areas. These areas will be developed as facilities are needed and funds permit.

The Bureau of Land Management, planning extensive development of recreational facilities on the lands it administers, has set aside 20 sites for future camp and picnic area development. There are several undeveloped state park tracts along the coast. Both the state and Coos County have recently acquired Bureau of Land Management land with ocean frontage for park develop-

ment. Facilities are being provided here as they are needed. Several of the private forest landowners are also likely to provide additional public recreational facilities in the future.

As forest land use becomes more intensive, the maintenance of recreation zones of varying width bordering lakes, streams, recreational developments, and main routes of travel used by recreationists will become more important. Commercial development and timber harvesting should be modified in these recreation zones to preserve the recreational values.

WATER

Water Yield

There are few watersheds in the South Coast Drainage Basin where a majority of the land does not have some kind of forest cover. Thus, it is obvious that forest land management has a considerable effect upon what happens to the water in the area between the time it falls as precipitation and the time it reaches the valleys in rivers and streams. The forest land manager can do little to influence total water yield in this area, but he can do a great deal to influence the timing of water flows and the quality of water that is produced.

It has been noted that the coastal mountain ranges are young geologically and are, thus, steep and rugged and are highly subject to erosion. Severe winter rainstorms, with up to 6 inches of precipitation in 24 hours, may last for several days until soils are completely saturated. Landslides, erosion, and floods have occurred under these conditions long before settlement of the area. Good watershed management practices will have little effect in preventing such natural phenomena, but much can be done to keep man's activity from accelerating the damage. For instance, when precipitation has completely saturated the soil, additional heavy precipitation will certainly result in floods, but good watershed management practices can result in a greater soil waterholding capacity and a minimum of silt and logging debris being carried by the floodwaters.

The snowpack is very small in this area and summer precipitation is light, so the summer water flows come from winter precipitation that has percolated through the soil and emerged as seeps and springs. Maintaining a healthy cover on the watershed will encourage rapid infiltration of winter precipitation and result in more uniform streamflows throughout the year.

Many of the fish species require cool water temperatures for survival. This is particularly true of anadromous species such as the spring-run chinook salmon, which spend the summer in fresh water before spawning. The necessary cool temperatures can be maintained only by providing sufficient water flows in the streams through the summer and providing shade along these streams through maintenance of tree and brush cover.

There are many management practices that will help enhance the value of forest land as watersheds, which can be instituted without diminishing the value of the land for other uses. These practices include:

1. Protection of the soil mantle over the entire watershed to

prevent soil erosion. This can be best accomplished by maintaining the vegetative cover over the soil. When the vegetative cover is removed, it should be restored as promptly and completely as possible. Large disturbed areas such as roads and landings should be provided with adequate drainage. Timber harvesting methods can be used that result in a minimum of soil disturbance.

2. Protection of streambanks and channels from disturbance during logging and road construction. Roads should be so located and constructed that sidecast material, slash, and debris is kept out of streams. Timber harvesting should be planned so that perennial streams are not disturbed by skidding and landing operations. Logging debris should be removed from streams.

3. Prevention of stream pollution. Adequate sanitation facilities should be provided at recreational areas and public cooperation enlisted to prevent pollution. Buffer strips should be left between recreational developments and lakes and streams.

These are examples of the many individual good practices that cumulatively add up to good watershed management.

There are some areas with very steep terrain and unstable soils in the South Coast Basin where logging and road location patterns should be extensively altered to prevent damage to the watershed. Some special considerations that can be given in these areas include careful analysis of road position in relation to critical soil stability, use of skyline-type logging equipment, and leaving logging slash unburned. Some forest land with extremely unstable soils should be excluded from timber harvesting until harvesting methods have been devised that will adequately protect the site.

Water Requirements for Forestry and Forest Industries

There are many kinds of water requirements, both consumptive and nonconsumptive, with relation to forest land management and the forest industries. Few quantitative estimates can be made of these requirements. Estimates of certain consumptive water requirements on national forest land are presented in table 18 as a sample of water use on forest land.

The largest single use of water in forested areas is for plant growth. This consumptive use is known as the evapo-transpiration process and is seldom measured.

Domestic. Domestic water uses with relation to forestry include:

1. Water used at forest administrative stations of both public agencies and private companies. Some stations are located in sizable towns and are served by municipal supplies.

2. Water required for domestic use by forest users including loggers, road builders, and stockmen while working or living

Table 18.--Estimated national forest consumptive water use 1/, South Coast Drainage Basin, Oreg.

Use	Subbasin 1 Sixes		2 Coquille		3 Coos		4 Chetco		Total	
	1961	2000	1961	2000	1961	2000	1961	2000	1961	2000
Domestic and other administrative stations 2/	3/	3/	0.05	0.10	...	0.03	0.01	0.01	0.06	0.14
Domestic at recreation areas	0.03	0.38	0.10	0.82	0.39	2.80	0.04	0.27	0.56	4.27
Domestic livestock	...	...	...	...	...	...	0.12	0.05	0.12	0.05
Wildlife	2.20	2.40	5.71	6.20	4.33	4.70	5.26	5.70	17.50	19.00
Road construction and maintenance	1.46	3.70	5.40	7.20	...	...	3.62	7.40	10.48	18.30
Fire control	0.02	0.02	0.10	0.10	0.01	0.01	0.15	0.15	0.28	0.28
Other	...	...	0.01	0.10	0.10	0.10	0.10	0.10	0.21	0.30
Total	3.71	6.50	11.37	14.52	4.83	7.64	9.30	13.68	29.21	42.34
Totals converted to acre feet	11	20	35	45	15	23	29	42	90	130

1/ Millions of gallons per year.
2/ Does not include water obtained from municipal or commercial supplies.
3/ Less than 10,000 gallons per year.

Source: Siskiyou and Siuslaw National Forests. Projections are based on national forest development as anticipated by local forest officials, assuming daily per capita water consumption will remain the same as at present.

in forested areas.

Water requirements for all of these purposes are expected to increase as forest areas are managed more intensively.

Livestock. Water requirements for livestock in forested areas include:

1. Water actually consumed by livestock.

2. Water stored in ponds and storage tanks (plus evaporation and seepage losses) to provide for needs of livestock.

As the value of forest land for wildlife, timber, and recreation increases, the use of forest land by livestock and water requirements for livestock on forest land will probably decrease.

Recreation. Recreational water uses in forested areas include:

1. Water consumed by recreational visitors to forest land.

2. Water in lakes and streams that are used for recreational purposes such as fishing, boating, swimming, and aesthetic enjoyment. This is a consumptive use only to the extent that water is consumed through evaporation from these bodies of water. Water levels in these lakes and streams need to be maintained at a level that makes them aesthetically attractive during the season of recreational use.

Water requirements for recreation are expected to increase rapidly as recreational use of forested areas increases.

Wildlife. Water requirements of wildlife on forest land include:

1. Water consumed by wildlife.

2. Water required as an environment for such wildlife as waterfowl and certain furbearers. There is some water consumption through evaporation from lakes and streams. Fairly uniform water levels must be maintained for some species, and water must be kept free of pollution.

Water requirements for wildlife are expected to increase slightly in the future, primarily due to expected increases in the deer and elk population.

Fish Life. Water requirements for fish life include the water in lakes and streams that is necessary environment for fish. There are certain water quality requirements as to temperature, oxygen content, and freedom from pollution and turbidity that must be met if fish and the aquatic plants and animals they feed on are to thrive. An important part of maintaining water quality is the maintenance of adequate stream flows and lake levels. When water quantities are low, especially during summer months, the water temperature is likely to rise, oxygen levels drop, and pollution increases because wastes are not carried away promptly. All fish species have certain special

requirements during the spawning season. Stream levels must be sufficient and stream channels open so that fish can travel to the spawning areas. Water and streambed conditions in the spawning areas must be suitable for each species.

Industrial. Water requirements for the forest industries include:

1. Water for construction and maintenance of forest access roads.

2. Water for operation of timber harvesting equipment.

3. Water for storage and transporation of logs.

4. Water for various primary and secondary manufacturing processes.

Some of the requirements will probably decrease in the future, but the overall industrial requirement will increase. Depending on our assumption that present timber harvest is about the same as potential timber growth, there should be little change in water requirements for timber harvesting, log storage, and log transporation. Most of the primary forest access road systems will be completed within about 30 years, so water use for road construction will decrease. As roads are used more heavily for recreation and other uses, dust palliative treatment will be required on more roads. However, materials other than water may be used for this purpose.

If there is increased diversification of the forest industries in the future, then more water will be required for manufacturing processes. For instance, while industry-wide water requirements for lumber manufacture are about 1 gallon per board foot, water requirements for pulp manufacture are 25,000 to 44,000 gallons per ton of dry raw material, varying with the pulping process used. Manufacture of pulp from the presently unutilized mill residues in Coos and Curry Counties (table 13) would require an annual water supply of about 45,000 to 80,000 acre feet. Similar utilization of sound wood presently left in the woods would require several times as much water. However, only a small fraction of this water would be consumptively used. Hardboard manufacture would require about one-fourth as much water as pulp manufacture.

Increased secondary wood manufacturing could also mean increased problems in treatment of effluent from the manufacturing processes.

Fire Control. Variable quantities of water are required for control of forest fires and slash disposal fires. Water must also be stored in ponds and storage tanks so it is readily available when needed. The amount of this requirement is not expected to change greatly in the future.

AGRICULTURE IN THE BASIN

INTRODUCTION

The dominant agricultural activities in the South Coast Basin are the production of milk, beef cattle, sheep, cranberries, and lily bulbs. These commodities have proven to be well adapted to the physical and economic conditions in the basin.

Dairying has developed in the Coos and Coquille Valleys and tidal areas where frequent flooding and restricted drainage limit agricultural use of land to the production of pasture. The upland rangeland and grazed forest land are utilized by cattle, sheep, and goats. Cranberries are well adapted to the organic soils and climatic conditions in the coastal area of lower Coquille and Sixes watersheds while lilies thrive in the Chetco Subbasin on the well-drained sandy soils south of Brookings. Other crops and livestock are raised in the basin, but these are the most important.

Agricultural Data

Data on land use, irrigation, drainage, flooding, and erosion are needed to analyze the present and potential use of land and water for agriculture. Published data are available on some of the items for Coos and Curry Counties, but more detailed information on small watersheds was desired to facilitate future planning and comparison of potential projects. To supplement published data and to obtain more detailed information for each subbasin, the USDA Field Party made a reconnaissance survey of 35 small watershed areas in the South Coast Drainage Basin. The location of the watershed areas is shown on the generalized irrigation map (fig. 19), and data for each watershed are shown in tables 19A through 19E. Water rights information was provided by the State Water Resources Board. The other information was estimated by local personnel of the Soil Conservation Service, the County Extension Service, and the Agricultural Stabilization and Conservation Service. Although the information is of a reconnaissance nature, published data such as the U. S. Census of Agriculture were used as a cross check on several items. Data from this survey are used throughout the remainder of this report.

LAND USE FOR AGRICULTURE

The predominant use of agricultural land in the basin is for the production of forage for livestock. The high precipitation and long growing season are conducive to the establishment and growth of a luxurious plant cover. Although forage production overshadows all other agricultural land uses, cranberry and lily bulb production are also important. In addition, small acreages are devoted to the production of corn, small grains, fruits, nuts, and other miscellaneous crops. In this report, agricultural land is classified as either grazing land other than cropland or cropland (table 20). Agricultural land use is shown on a map in figure 5.

Grazed Forest Land and Rangeland

In terms of acreage, grazed forest land and rangeland constitue the major agricultural use of land in the basin. About 199,100 acres, or 10 percent of the total area of the basin, are in this use. Grazed forest land

Table 19A.--Reconnaissance data on tributary streams studied, Sixes, Subbasin 1, South Coast Drainage Basin, Oreg., 1961

Item	Unit	1 Brush Creek	2 Croft Lake	3 Elk River	4 Euchre River	5 Floras Creek	6 Fourmile Creek	7 Hubbard Creek	8 Mussel Creek	9 Nesika Beach	10 New Lake	11 Sixes River	Total of tributaries studied	Other area in subbasin	Total Subbasin 1
Number of farms	Farms	5	15	20	6	35	15	3	3	4	15	40	161	...	161
LAND USE:															
Woodland pastured	Acres	570	100	400	262	22,000	5,582	...	270	340	2,450	2,796	34,770	...	34,770
Woodland not pastured	do	7,940	2,240	58,366	24,011	22,883	5,582	4,210	6,065	1,700	600	73,969	207,566	700	208,266
Cropland	do	...	210	1,814	401	1,577	736	50	61	50	1,422	1,565	7,886	...	7,886
Other pasture	do	780	600	180	590	10,120	1,900	...	...	970	2,548	3,610	21,298	600	21,898
Other	do	2,000	700	350	196	1,000	500	50	4	400	1,400	1,300	7,900	2,160	10,060
Total watershed area	do	11,290	3,850	61,110	25,460	57,580	14,300	4,310	6,400	3,460	8,420	83,240	279,420	3,460	282,880
Cropland use															
Dryland															
Pasture	Acres	...	150	1,280	351	1,194	650	50	57	50	1,400	1,395	6,577	...	6,577
Other	do	...	...	...	...	...	...	...	4	...	...	...	4	...	4
Total	do	...	150	1,280	351	1,194	650	50	61	50	1,400	1,395	6,581	...	6,581
Irrigated															
Pasture	Acres	...	...	534	45	369	50	...	...	...	...	136	1,134	...	1,134
Cranberries	do	...	55	...	...	4	36	...	...	...	4	34	133	...	133
Lily bulbs	do	...	...	...	5	...	...	...	...	...	14	...	19	...	19
Other	do	...	5	...	...	10	...	...	...	...	4	...	19	...	19
Total	do	...	60	534	50	383	86	...	...	...	22	170	1,305	...	1,305
Potential cropland	Acres	...	500	1,000	...	1,000	1,500	...	...	...	800	1,000	5,800	...	5,800
IRRIGATION:															
Surface water rights	Acres	...	43	291	9	327	128	...	7	1	42	76	924	5	929
Ground water rights	do	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	do	...	43	291	9	327	128	...	7	1	42	76	924	5	929
Water source															
Direct stream diversion	Acres	...	...	...	...	40	...	...	...	...	...	...	40	...	40
Pumped from streams	do	...	...	534	50	343	50	...	...	...	...	170	1,147	...	1,147
Pumped from wells	do	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Other	do	...	60	...	...	...	36	...	...	...	22	...	118	...	118
Total	do	...	60	534	50	383	86	...	...	...	22	170	1,305	...	1,305
Water shortage	Acres	...	...	...	...	...	36	...	...	...	...	34	70	...	70
Method of application															
Sprinkling	Acres	...	60	534	50	343	86	...	...	...	22	170	1,265	...	1,265
Flooding	do	...	...	...	...	40	...	...	...	...	...	...	40	...	40
Total	do	...	60	534	50	383	86	...	...	...	22	170	1,305	...	1,305
Potential irrigated land	Acres	...	600	2,000	176	2,500	1,650	30	61	...	500	1,800	9,317	...	9,317
Water source for potential irrigated land															
Natural flows	Acres	...	150	500	50	800	650	30	30	...	200	200	2,610	...	2,610
Storage	do	...	450	1,500	126	1,700	1,000	...	31	...	300	1,600	6,707	...	6,707
Total	do	...	600	2,000	176	2,500	1,650	30	61	...	500	1,800	9,317	...	9,317
STORAGE:															
Existing															
Ponds	Number	...	...	...	...	...	...	...	...	...	...	1	1	...	1
Reservoirs	do	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Possible reservoir sites	Number	...	...	2	2	7	1	...	...	...	...	3	15	...	15
DRAINAGE:															
Arable land with wet soil	Acres	...	600	112	105	2,000	1,300	30	16	...	1,000	800	5,963	...	5,963
Needs															
Tide gate and dike	Acres	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Improved surface drainage	do	...	600	112	...	1,600	1,000	...	...	...	1,000	800	5,112	...	5,112
Subsurface drainage															
Open drains	do	...	600	112	100	...	800	30	16	...	1,000	...	2,658	...	2,658
Closed drains	do	...	...	...	5	...	...	...	11	...	...	...	16	...	16
Flooded areas	Acres	...	100	1,200	105	1,500	175	60	...	...	850	800	4,790	...	4,790

Source: Based on a survey by the U. S. Dept. of Agriculture Field Party. Estimates provided by local personnel of the Soil Conservation Service County Extension Service, and Agricultural Stabilization and Conservation Service.

Table 19B.--Reconnaissance data on tributary streams studied, Coquille, Subbasin 2, South Coast Drainage Basin, Oreg., 1961

Item	Unit	1 Central Coquille River	2 Lower Coquille River	3 Middle Fork Coquille River	4 Northeast Fork Coquille River	5 South Fork Coquille River	Total Subbasin 2
Number of farms	Farms	122	230	97	191	109	749
LAND USE:							
Woodland pastured	Acres	18,000	16,000	10,000	8,000	15,000	67,000
Woodland not pastured	do	31,900	43,150	177,600	167,280	123,780	543,710
Cropland	do	9,100	13,500	6,250	3,750	1,150	33,750
Other pasture	do	6,000	15,000	2,500	4,000	15,000	42,500
Other	do	2,500	3,000	2,700	2,500	2,500	13,200
Total watershed area	do	67,500	90,650	199,050	185,530	157,430	700,160
Cropland use							
Dryland							
Pasture	Acres	6,750	12,500	5,655	1,250	350	26,505
Other	do	100	150	225	235	150	860
Total	do	6,850	12,650	5,880	1,485	500	27,365
Irrigated							
Pasture	Acres	2,250	500	350	2,250	650	6,000
Cranberries	do	...	350	...	...	...	350
Lily bulbs	do	...	...	...	15	...	15
Other	do	...	...	20	...	...	20
Total	do	2,250	850	370	2,265	650	6,385
Potential cropland	Acres	2,000	9,000	2,000	2,000	900	15,900
IRRIGATION:							
Surface water rights	Acres	1,151	893	695	1,522	1,106	5,367
Ground water rights	do	...	31	...	...	...	31
Total	do	1,151	924	695	1,522	1,106	5,398
Water source							
Direct stream diversion	Acres	...	150	...	...	...	150
Pumped from streams	do	2,250	500	370	2,265	650	6,035
Pumped from wells	do	...	...	...	...	...	...
Other	do	...	200	...	...	...	200
Total	do	2,250	850	370	2,265	650	6,385
Water shortage	Acres	500	...	180	600	...	1,280
Method of application							
Sprinkling	Acres	2,250	730	370	2,265	650	6,265
Flooding	do	...	120	...	...	...	120
Total	do	2,250	850	370	2,265	650	6,385
Potential irrigated land	Acres	6,100	16,000	4,500	3,235	800	30,635
Water source for potential irrigated land							
Natural flows	Acres	4,000	1,000	2,100	2,000	200	9,300
Storage	do	2,100	15,000	2,400	1,235	600	21,335
Total	do	6,100	16,000	4,500	3,235	800	30,635
STORAGE:							
Existing							
Ponds	Number	4	30	4	2	4	44
Reservoirs	do	4	1	...	1	...	6
Possible reservoir sites	Number	5	17	10	6	3	41
DRAINAGE:							
Arable land with wet soil	Acres	6,000	13,000	1,700	1,000	400	22,100
Needs							
Tide gate and dike	Acres	1,000	2,000	...	...	...	3,000
Improved surface drainage	do	6,000	13,000	1,200	600	300	21,100
Subsurface drainage							
Open drains	do	5,000	8,000	1,100	600	100	14,800
Closed drains	do	1,000	5,000	700	400	200	7,300
Flooded areas	Acres	7,000	10,000	600	1,500	1,200	20,300

Source: Based on a survey by the U. S. Dept. of Agriculture Field Party. Estimates provided by local personnel of the Soil Conservation Service, County Extension Service, and Agricultural Stabilization and Conservation Service.

Table 19C.--Reconnaissance data on tributary streams studied, Coos, Subbasin 3, South Coast Drainage Basin, Oreg., 1961

Item	Unit	1 Catching Slough	2 Coalbank Slough	3 Haynes Inlet	4 Isthmus Slough	5 Kentuck Slough	6 Larson Slough	7 Lower Coos River	8 Millicoma River	9 North Slough	10 South Fork Coos River	11 South Slough	12 Tenmile Lake	13 Willanch Slough	Total of tributaries studied	Other area in subbasin	Total Subbasin 3
Number of farms	Parms	63	12	19	20	17	16	18	25	11	26	5	70	12	314	20	334
LAND USE:																	
Woodland pastured	Acres	200	200	100	500	200	100	200	150	200	150	1,200	...	100	3,300	1,000	4,300
Woodland not pastured	do	15,440	3,224	6,320	14,950	9,180	5,580	3,180	95,530	7,495	159,620	15,487	37,750	4,365	378,121	25,350	403,471
Cropland	do	1,500	536	550	350	740	370	1,800	700	420	800	153	1,820	360	10,099	435	10,534
Other pasture	do	300	...	60	250	600	40	...	100	...	100	600	400	100	2,550	600	3,150
Other	do	300	200	90	650	200	60	150	1,000	75	1,600	170	4,350	75	8,920	36,105	45,025
Total watershed area	do	17,740	4,160	7,120	16,700	10,920	6,150	5,330	97,480	8,190	162,270	17,610	44,320	5,000	402,990	63,490	466,480
Cropland use																	
Dryland																	
Pasture	Acres	1,400	536	450	350	600	250	1,770	450	400	550	150	1,650	225	8,781	410	9,191
Other	do	...	...	...	...	40	20	...	...	...	50	...	20	10	140	...	140
Total	do	1,400	536	450	350	640	270	1,770	450	400	600	150	1,670	235	8,921	410	9,331
Irrigated																	
Pasture	Acres	100	...	100	...	100	100	30	250	...	200	...	150	125	1,155	...	1,155
Cranberries	do	...	...	...	...	...	...	...	...	20	...	3	...	...	23	25	48
Lily bulbs	do	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Other	do	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	do	100	...	100	...	100	100	30	250	20	200	3	150	125	1,178	25	1,203
Potential cropland	do	600	100	50	250	80	50	250	200	500	300	200	300	75	2,955	...	2,955
IRRIGATION:																	
Surface water rights	Acres	77	17	13	209	105	190	35	201	83	5	82	58	105	1,180	25	1,205
Ground water rights	do	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	do	77	17	13	209	105	190	35	201	83	5	82	58	105	1,180	25	1,205
Water source																	
Direct stream diversion	Acres	...	...	...	...	...	...	...	...	20	...	...	...	...	20	...	20
Pumped from streams	do	100	...	100	...	100	100	30	250	...	200	3	150	125	1,158	25	1,183
Pumped from wells	do	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Other	do	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	do	100	...	100	...	100	100	30	250	20	200	3	150	155	1,178	25	1,203
Water shortage	Acres	100	...	...	...	...	...	...	...	...	...	...	...	...	100	...	100
Method of application																	
Sprinkling	Acres	100	...	100	...	100	100	30	250	...	200	3	150	125	1,158	25	1,183
Flooding	do	...	...	...	...	...	...	...	...	20	...	...	...	...	20	...	20
Total	do	100	...	100	...	100	100	30	250	20	200	3	150	125	1,178	25	1,203
Potential irrigated land	Acres	1,400	536	350	600	720	250	1,770	650	550	900	350	1,670	235	9,981	...	9,981
Water source for potential irrigated land																	
Natural flows	Acres	...	...	350	200	620	250	...	200	550	200	350	1,300	135	4,155	...	4,155
Storage	do	1,400	536	...	400	100	...	1,770	450	...	700	...	370	100	5,826	...	5,826
Total	do	1,400	536	350	600	720	250	1,770	650	550	900	350	1,670	235	9,981	...	9,981
STORAGE:																	
Existing																	
Ponds	Number	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	2
Reservoirs	do	...	...	...	1	...	...	...	...	...	...	...	...	...	1	...	2
Possible reservoir sites	Number	1	...	1	1	...	...	...	7	2	6	1	5	...	24	1	25
DRAINAGE:																	
Arable land with wet soil	Acres	1,300	536	350	600	275	300	900	250	450	250	350	600	200	6,361	...	6,361
Needs																	
Tide gate and dike	Acres	1,000	...	150	300	100	100	200	100	150	100	150	...	150	2,500	...	2,500
Improved surface drainage	do	1,300	536	350	600	275	300	900	250	450	250	350	600	200	6,361	...	6,361
Subsurface drainage																	
Open drains	do	1,100	536	350	600	200	300	600	100	450	200	350	450	150	5,386	...	5,386
Closed drains	do	200	...	...	...	75	...	300	150	...	50	...	100	50	925	...	925
Flooded areas	Acres	...	536	400	300	200	400	...	100	400	500	150	150	200	3,336	...	3,336

Source: Based on a survey by the U. S. Dept. of Agriculture Field Party. Estimates provided by local personnel of the Soil Conservation Service, County Extension Service, and Agricultural Stabilization and Conservation Service.

Table 19D.--Reconnaissance data on tributary streams studied, Chetco, Subbasin 4, South Coast Drainage Basin, Oreg., 1961

Item	Unit	1 Cape Ferrelo	2 Chetco River	3 Harbor Area	4 Hunter Creek	5 Pistol River	6 Winchuck River	Total of tributaries studied	Other areas in basin	Total Chetco Basin
Number of farms	Farms	18	20	55	3	10	8	114	...	114
LAND USE:										
Woodland pastured	Acres	5,680	2,075	1,050	800	1,000	740	11,345	...	11,345
Woodland not pastured	do	8,700	225,070	...	27,080	61,998	35,632	358,480	65,570	424,050
Cropland	do	205	310	1,050	70	392	538	2,565	...	2,565
Other pasture	do	4,135	2,765	1,050	550	4,460	990	13,950	200	14,150
Other	do	2,200	1,600	350	1,000	600	300	6,050	2,000	8,050
Total watershed area	do	20,920	231,820	3,500	29,500	68,450	38,200	392,390	67,770	460,160
Cropland use										
Dryland										
Pasture	Acres	195	240	300	50	380	428	1,593	...	1,593
Other	do	...	...	530	...	...	...	530	...	530
Total	do	195	240	830	50	380	428	2,123	...	2,123
Irrigated										
Pasture	Acres	...	50	30	...	...	110	190	...	190
Cranberries	do	...	...	...	...	...	...	...	...	...
Lily bulbs	do	10	20	190	20	12	...	252	...	252
Other	do	...	...	...	...	...	...	...	...	...
Total	do	10	70	220	20	12	110	442	...	442
Potential cropland	Acres	...	...	50	...	...	...	50	...	50
IRRIGATION:										
Surface water rights	Acres	67	71	242	35	41	124	580	...	580
Ground water rights	do	...	...	163	3	...	...	166	...	166
Total	do	67	71	405	38	41	124	746	...	746
Water source										
Direct stream diversion	Acres	...	...	...	...	...	...	...	...	...
Pumped from streams	do	...	70	...	20	...	110	200	...	200
Pumped from wells	do	10	...	143	...	12	...	165	...	165
Other	do	...	...	77	...	...	...	77	...	77
Total	do	10	70	220	20	12	110	442	...	442
Water shortage	Acres	...	...	143	...	...	...	143	...	143
Method of application										
Sprinkling	Acres	10	70	220	20	12	110	442	...	442
Flooding	do	...	...	...	...	...	...	...	...	...
Total	do	10	70	220	20	12	110	442	...	442
Potential irrigated land	Acres	...	100	930	40	300	300	1,670	...	1,670
Water source for potential irrigated land										
Natural flows	Acres	...	...	...	40	300	300	640	...	640
Storage	do	...	100	930	...	...	...	1,030	...	1,030
Total	do	...	100	930	40	300	300	1,670	...	1,670
STORAGE:										
Existing										
Ponds	Number	...	...	2	...	...	...	2	...	2
Reservoirs	do	...	...	...	...	...	...	...	...	...
Possible reservoir sites	Number	...	2	...	1	...	3	6	...	6
DRAINAGE:										
Arable land with wet soil	Acres	20	20	200	...	30	10	280	...	280
Needs										
Tide gate and dike	Acres	...	...	...	...	...	...	...	...	...
Improved surface drainage	do	20	...	200	...	30	10	280	...	280
Subsurface drainage										
Open drains	do	...	20	100	...	30	10	160	...	160
Closed drains	do	...	...	120	...	...	...	120	...	120
Flooded areas	Acres	...	125	...	30	300	10	465	...	465

Source: Based on a survey by the U. S. Dept. of Agriculture Field Party. Estimates provided by local personnel of the Soil Conservation Service, County Extension Service, and Agricultural Stabilization and Conservation Service.

Table 19E.--Summary of reconnaissance data on tributary streams studied, South Coast Drainage Basin, Oreg., 1961

Item	Unit	Subbasin 1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
Number of farms	Farms	161	749	334	114	1,358
LAND USE:						
Woodland pastured	Acres	34,770	67,000	4,300	11,345	117,415
Woodland not pastured	do	208,266	543,710	403,471	424,050	1,579,497
Cropland	do	7,886	33,750	10,534	2,565	54,735
Other pasture	do	21,898	42,500	3,150	14,150	81,698
Other	do	10,060	13,200	45,025	8,050	76,335
Total watershed area	do	282,880	700,160	466,480	460,160	1,909,680
Cropland use						
Dryland						
Pasture	Acres	6,577	26,505	9,191	1,593	43,866
Other	do	4	860	140	530	1,534
Total	do	6,581	27,365	9,331	2,123	45,400
Irrigated						
Pasture	Acres	1,134	6,000	1,155	190	8,479
Cranberries	do	133	350	48	...	531
Lily bulbs	do	19	15	...	252	286
Other	do	19	20	...	...	39
Total	do	1,305	6,385	1,203	442	9,335
Potential cropland	Acres	5,000	15,900	2,955	50	23,905
IRRIGATION:						
Surface water rights	Acres	929	5,367	1,205	580	8,081
Ground water rights	do	...	31	...	166	197
Total	do	929	5,398	1,205	746	8,278
Water source						
Direct stream diversion	Acres	40	150	20	...	210
Pumped from streams	do	1,147	6,035	1,183	200	8,565
Pumped from wells	do	...	...	...	165	165
Other	do	118	200	...	77	395
Total	do	1,305	6,385	1,203	442	9,335
Water shortage	Acres	70	1,280	100	143	1,593
Method of application						
Sprinkling	Acres	1,265	6,265	1,183	442	9,135
Flooding	do	40	120	20	...	180
Total	do	1,305	6,385	1,203	442	9,335
Potential irrigated land	Acres	9,317	30,635	9,981	1,670	52,603
Water source for potential irrigated land						
Natural flows	Acres	2,610	9,300	4,155	640	16,705
Storage	do	6,707	21,335	5,826	1,030	34,898
Total	do	9,317	30,635	9,981	1,670	51,603
STORAGE:						
Existing						
Ponds	Number	1	44	2	2	49
Reservoirs	do	...	6	2	...	8
Possible reservoir sites	Number	15	41	25	6	87
DRAINAGE:						
Arable land with wet soil	Acres	5,963	22,100	6,361	280	34,704
Needs						
Tide gate and dike	Acres	...	3,000	2,500	...	5,500
Improved surface drainage	do	5,112	21,100	6,361	280	32,853
Subsurface drainage						
Open drains	do	2,658	14,800	5,386	160	23,004
Closed drains	do	16	7,300	925	120	8,361
Flooded areas	Acres	4,790	20,300	3,336	465	28,891

Source: Based on a survey by the U. S. Dept. of Agriculture Field Party. Estimates provided by local personnel of the Soil Conservation Service, County Extension Service, and Agricultural Stabilization and Conservation Service.

Table 20.--Agricultural land use, South Coast Drainage Basin, Oreg., 1961

Agricultural land use	Subbasin 1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
	Acres	Acres	Acres	Acres	Acres
Grazing land:					
Forest land	34,800	67,000	4,300	11,300	117,400
Rangeland	21,900	42,500	3,100	14,200	81,700
Total grazing land	56,700	109,500	7,400	25,500	199,100
Cropland:					
Dryland					
Pasture and hay	6,580	26,500	9,190	1,590	43,860
Other	10	860	140	530	1,540
Total	6,590	27,360	9,330	2,120	45,400
Irrigated					
Pasture and hay	1,130	6,000	1,160	190	8,480
Cranberries	130	350	50	...	530
Bulbs and flowers	20	20	...	250	290
Other	20	20	...	...	40
Total	1,300	6,390	1,210	440	9,340
Total cropland	7,890	33,750	10,540	2,560	54,740

Source: USDA Field Party survey data (table 19).

is defined as land grazed by livestock that is at least 10 percent stocked with trees. This land usually consists of cutover areas which support a cover of brush or timber reproduction of poor character. Periodic fires have hindered the successful re-establishment of commercial timber stands. Forage production on this land is low, and the recent increase in timber values has encouraged some farmers to convert it to timber production. Most of the forested grazing land is in the Coquille and Sixes Subbasins.

The rangeland consists of small, isolated areas of prairie-type grassland on which trees or brush have never grown and land which has been improved for grazing by slashing, burning, and seeding to perennial grasses or mixtures of grasses and legumes. About 52 percent of the rangeland is in the Coquille Subbasin; 27 percent is in the Sixes Subbasin; 17 percent is in the Chetco Subbasin; and only 4 percent is in the Coos Subbasin.

Cropland

In this report, cropland is defined as land in capability classes I through IV that is used for the production of crops or pasture. Approximately 54,740 acres, less than 3 percent of the basin, is cropland. Most cropland is located on the valley floors adjacent to major streams. Use of most of this land is presently limited to pasture because of flooding and drainage problems. Although only 52,340 acres, or 2.7 percent of the basin, is used for cropland pasture, it provides the forage base for the thriving dairy enterprises and a portion of the forage for the beef and sheep enterprises.

Figure 11 Natural rangeland and grazed forest land in a 110 inch rainfall area of the Chetco Subbasin.

Figure 12 Improved cropland pasture in the Elk River Drainage, Sixes Subbasin.

The forage is utilized by grazing or for feed as hay or silage. Census data indicate that hay or silage is harvested from about 34 percent of the cropland pasture.

Forage yields from cropland pasture vary considerably in the basin depending upon such factors as soils, plant type, drainage, flooding, growing season, rainfall, irrigation, and management practices. The only readily available source of yield information is the Census of Agriculture which lists average yields of hay and silage. In 1959, the average yield for all hayland in Coos and Curry Counties was 1.8 tons per harvested acre. The average yield for clover and grass mixtures was slightly higher at 2.2 tons per harvested acre. Silage yields averaged 8.2 tons per acre. However, these yields do not reflect total forage production because most of the acreage harvested for hay and silage is also pastured.

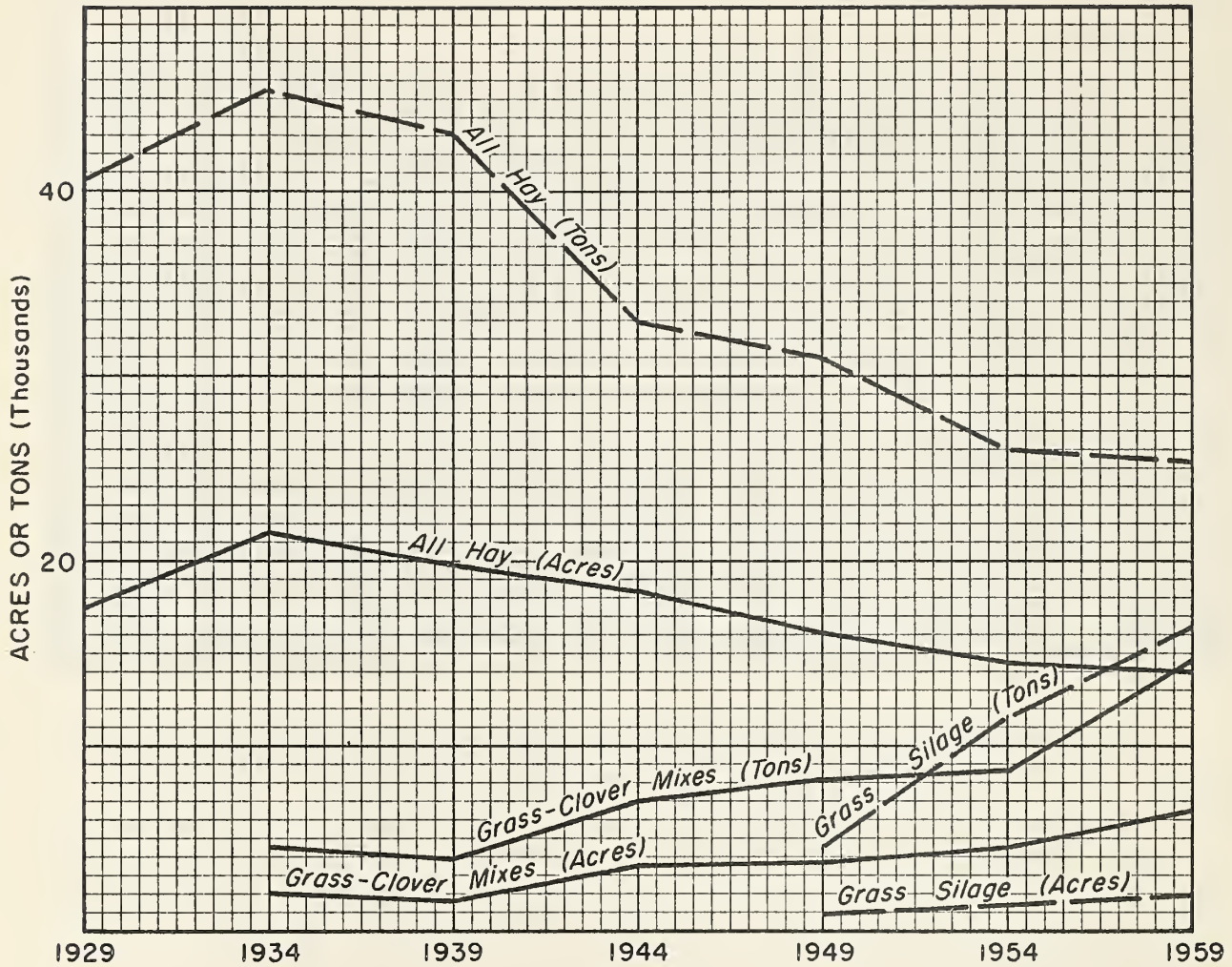
Census data show no appreciable difference in hay yields on irrigated and nonirrigated land. However, forage available for grazing would normally be considerably higher on irrigated land. The Coos County Committee on Irrigation reported at the State Water Resources Board Hearing that dryland hay yields of 3 tons per acre could be increased to 6 tons per acre under irrigation. Any analysis of yields on irrigated and nonirrigated land should consider several factors such as soil type, drainage, flooding, soil fertility, and plant type. Time limitations prohibited obtaining this detailed information.

Other important agricultural uses of cropland in the basin are for the production of cranberries and lily bulbs. Most of the cranberries are produced in the coastal area between the Coquille and Elk Rivers. A few cranberry bogs are located around Coos Bay in the Coos Subbasin. The cranberries are grown in bogs which range from less than 1 acre to 20 acres in size. The bogs are on peat or podzolized soils, and development requires a considerable amount of labor to clear, level, sand, and dike the area. Sprinkler irrigation systems are used not only to irrigate the cranberries but also to prevent frost damage. Yields average from 9,000 to 10,000 pounds of cranberries per acre.

Lily bulb production is concentrated in the coastal area south of Brookings, Oreg. About 290 acres are presently devoted to the production of this crop. A crop rotation system including grass and clover is used to control diseases of lilies.

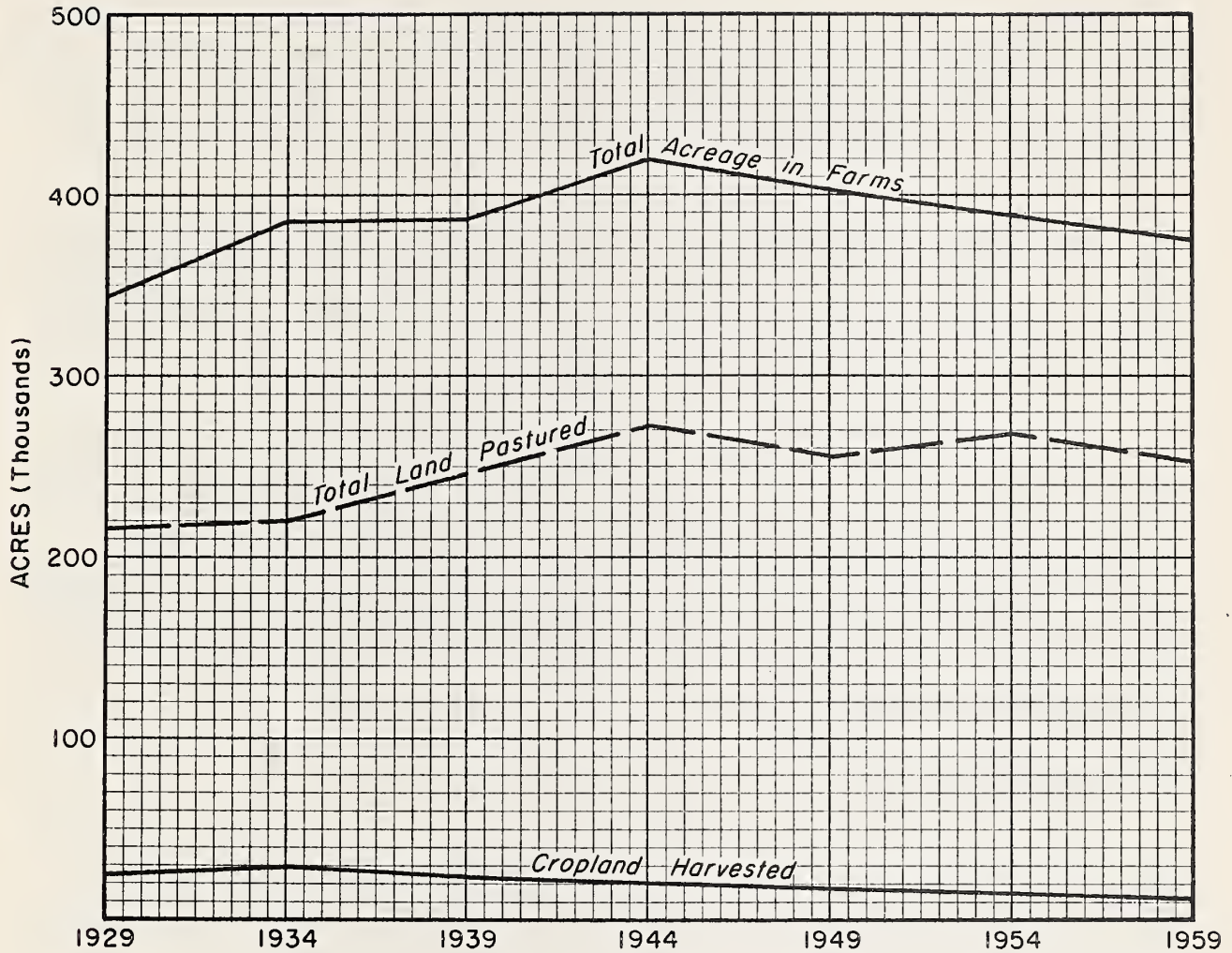
Trends in Land Use

Trends in agricultural land use are shown in figures 13 and 14. Total acreage in farms increased from 1929 to 1944 but has steadily decreased since 1944. Acreage in farms is not a very good measure of agricultural resources because it includes sizable acreages of commercial timberland. Total land pastured is a more meaningful measure. Acreage pastured increased from 1929 to 1944 and has decreased only slightly since that time (fig. 14). Harvested cropland acreage has been decreasing since 1934 (fig. 14). This reduction is a result of fewer acres being harvested for hay (fig. 13). At the same time, harvested acreage and production of grass-clover mixes cut for hay has been increasing. Harvested acreage for grass silage has also increased since 1949 but not nearly as fast as production of grass silage. Silage has several



Source: U.S. Census of Agriculture data for Coos and Curry Counties, Oregon.

Figure 13: Harvested acreage and production of hay and silage, for two principal counties in the South Coast Drainage Basin, Oregon, 1929-1959.



Source: U.S. Census of Agriculture data for Coos and Curry Counties, Oregon.

Figure 14: Total farmland, pastured land, and cropland harvested, for two principal counties in the South Coast Drainage Basin, Oregon, 1929-1959.

advantages over hay in this area. Damage to hay by rain and fog is a problem, but it is not with silage. It is also reported that silage produces more milk per acre than hay, is more palatable, and is less costly to store than hay. 1/ Because of production and storage problems, the basin continues to be a hay deficit area. In Coos County alone, over 4,000 tons of hay are shipped in annually. 1/

Cranberries have been grown in the Bandon area since 1885 when plantings were brought from Massachusetts. The acreage was gradually increased, and by 1949, 268 acres were devoted to cranberry production. Cranberry acreage has increased rapidly since 1949 to 479 acres in 1954 and to 530 acres in 1961. Development of additional land for cranberry production is continuing even though prices received for cranberries have declined.

The production of lily bulbs began on a commercial scale in the Brookings area in the 1930's. Production was expanded rapidly in the early 1940's to about 600 acres after the importation of Japanese-grown bulbs to the United States was stopped during World War II. Over production resulted in a lowering of prices for bulbs, and acreage in production decreased to 240 acres in 1954 where it has remained fairly constant. In the last few years, disease problems and high land values have discouraged expansion of lily acreage in the area, and some producers are moving their bulb operations to California.

CHARACTERISTICS OF AGRICULTURE

Number and Size of Farm

There are 1,358 farms and ranches in the basin. Census data indicates that approximately 54 percent are commercial farms; 39 percent are part-time farms; and 7 percent are part-retirement farms. 2/ Over half of the farms (749) are in the Coquille Subbasin; one-fourth (334) are in the Coos Subbasin; 161 are in the Sixes Subbasin; and 114 are in the Chetco Subbasin.

Average farm size in the basin is about 280 acres. However, most farms are considerably smaller than average. Table 21 shows distribution of farm size by acreage intervals for Coos and Curry Counties. Note that one-third of the farms are less than 50 acres in size and three-fourths are less than 259 acres in size. The more intensive farms such as cranberry and lily bulb farms are almost all within the 50 acre or less size group. In 1959, the average acreage per grower was about 4 acres for cranberries and 5 acres for lilies. Most of the dairy farms and part-time farms are under 259 acres in size. Beef and sheep farms, however, are much larger; and although they are fewer in number, they increase the numerical average size for all farms. Also, some farmers own sizable tracts of commercial timber land which is in-

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1/ Source: Report of Agricultural Planning Conference, Coquille County Planning Committee, Coquille, Oreg., 1956.

2/ Commercial farms include all farms with a value of sales amounting to $2,500 or more. Part-time farms include farms with value of sales of farm products of $50 to $2,499 and operators under 65 years of age that either worked off the farm 100 days or more or had other income for nonfarm sources that was greater than the total value of farm products sold. Farms with a value of sales of farm products of $50 to $2,499 were classified as part-retirement if the farm operator was 65 years old or over.

Table 21.--Percentage distribution of farm size for Coos and Curry Counties, Oreg., 1959

Size of farm	Percentage distribution of farms
	Percent
Under 50 acres	33
50 to 139 acres	23
140 to 259 acres	19
260 or more acres	25
Total	100

Source: U. S. Census of Agriculture.

cluded in the census figures as farmland.

Agriculture in the basin, as in the nation, is undergoing several changes. Most of these changes are a result of improved technology which tends to be associated with a large farm unit and with greater production per acre and per animal unit. This combined with the desire to increase farm income through increased production per farm contributes to the merging of small farms into larger units. Figure 15 shows the trend in number of farms and average farm size in Coos and Curry Counties. Since 1944, farm numbers have decreased steadily while average farm size has increased. At the same time, the average value of land and buildings has increased from $6,650 per farm to $30,780 per farm.

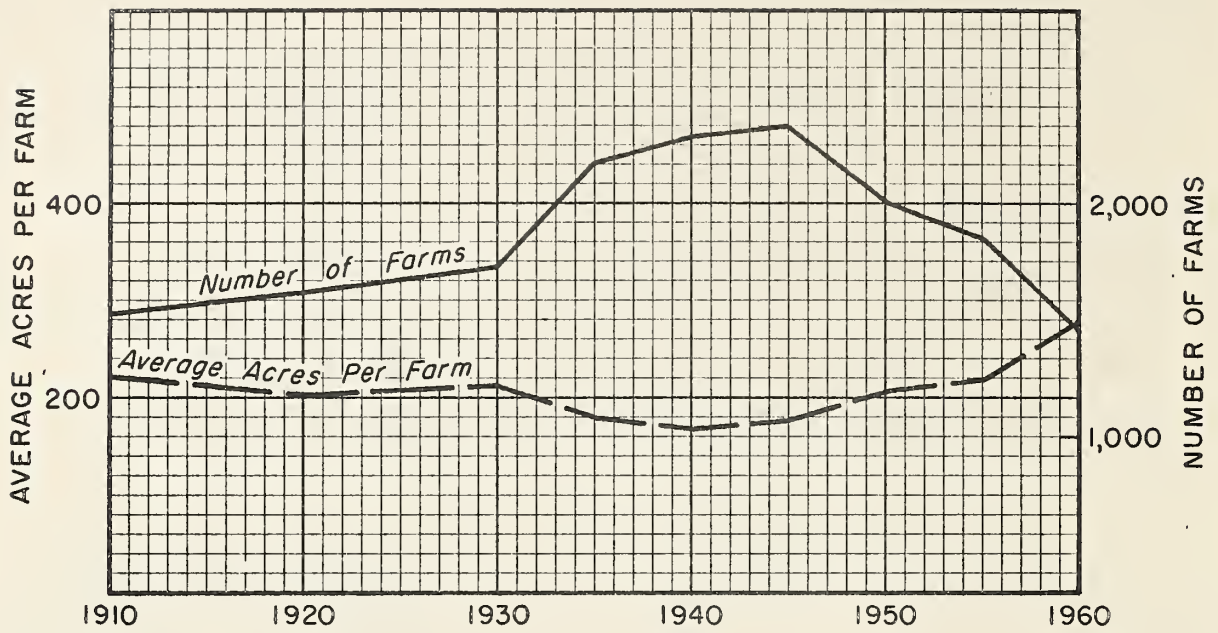
Paralleling the trend toward fewer farms is the trend toward greater reliance on off-farm work by the farmers who remained on their farms. The rapid growth of the lumber industry in the basin has provided opportunities for off-farm employment, and there has been an increase in the proportion of farmers who work off their farms. The percentage of farmers working 100 days or more off their farms increased from 35 percent in 1940 to 49 percent in 1959. The fact that many farm families are engaged in other activities besides farming is further reflected by 1959 census data which show that 56 percent of the farm families have other income which exceeds the value of farm products sold.

Tenure

Most of the farmers in the basin own their farms. Census data for Coos and Curry Counties indicate that in 1959, 83 percent of the farmers owned all the land in their farms (table 22). This tenure group owned 70 percent of the land in farms. Ten percent of the farmers were part owners and operated 22 percent of the land, and 6 percent were tenants and operated 6 percent of the farmland.

Livestock

In the preceding sections it was stated that forage production was the most widespread agricultural use of land in the basin. The most important method of utilizing forage in the basin is through dairy cows for the pro-



Source : U.S. Census of Agriculture data for Coos and Curry Counties, Oregon.

Figure 15: Number of farms and average acreage per farm for two principal counties in the South Coast Drainage Basin, Oregon, 1910-1960.

Table 22.--Distribution of farm operators and farmland by tenure, Coos and Curry Counties, Oreg., 1959

Tenure of farm operators	Percentage distribution of farm operators	Percentage distribution of farmland
	Percent	Percent
Full owners	83	70
Part owners	10	22
All tenants	6	6
Managers	1	2
Total	100	100

Source: U. S. Census of Agriculture.

duction of milk. The 12,130 milk cows in the basin provided almost half of the agricultural income in 1959. Most of the dairy farms are located on the broad valley floors of the Coquille and Coos Subbasins. The fertile soils provide forage for grazing, hay, and silage which is utilized for milk production.

Beef cattle are the second most important source of farm income. They are raised throughout the basin but are most numerous in the Coquille and Sixes Subbasins. Forage from rangeland and cropland pasture are the most important sources of feed for these animals.

Sheep are well adapted to the rangeland and forested grazing land in the basin. These animals graze the entire year and are gathered only when necessary for tagging, inoculating, shearing, and marketing. The animals are not herded but graze at will. Confinement is accomplished by fences, topography, or dense forests and brush lands, and each individual's flock grazes on land controlled by him. Numerous streams and springs provide ample stock water in most areas. Other livestock in the basin include 690 head of horses and mules, 2,970 head of goats, and about 1,500 head of swine scattered on farms throughout the basin (table 23).

The trend in livestock numbers appears to be toward more sheep, lambs, and beef cattle, and fewer milk cows, goats, horses, and mules. Milk cow numbers have decreased steadily since 1944 (fig. 16). This decline is consistent with the national trend and is associated with several factors. The decline in consumption of dairy products per capita and the rapid rise in milk production per cow are two of the most important. Adjustments to these conditions have been achieved through a reduction of milk cows and an even greater reduction in the number of dairy farms. In 1944, there were 17,453 milk cows and 696 dairy farms in Coos and Curry Counties. By 1959, milk cow numbers had dropped to 12,085, and the number of dairy farms had decreased to 253. At the same time, milk production dropped from about 94 million pounds in 1944 to about 77 miilion pounds in 1959. Thus, milk cow numbers decreased by 31 percent, dairy farms by 64 percent, and milk production by only 18 percent.

Sheep numbers have increased more than any other livestock in the area. The presence of predatory animals is one factor that has favored cattle pro-

Table 23.--Livestock numbers, South Coast Drainage Basin, Oreg., 1959

Type of livestock	Number of livestock				
	Subbasin				
	1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
	Number	Number	Number	Number	Number
Milk cows	1,360	7,820	2,660	290	12,130
All other cattle	4,550	15,700	2,050	1,350	23,650
Total cattle	5,910	23,520	4,710	1,640	35,780
Sheep and lambs	21,520	30,850	680	10,130	63,180
Horses and mules	100	450	50	90	690
Goats and kids	500	550	240	1,680	2,970

Source: Based on data from U. S. Census of Agriculture and data from the USDA Field Party survey (table 19).

duction over sheep in some areas. On the other hand, cattle are not grazed in other areas because of the presence of tansy ragwort. Tansy ragwort is a plant that is poisonous to both cattle and horses, but sheep eat it and thrive.

Goats, used in the past for removing brush, have become less numerous in recent years. Most of those remaining are found in the Chetco Subbasin where they run wild. Horses, no longer needed for power, are also decreasing in number.

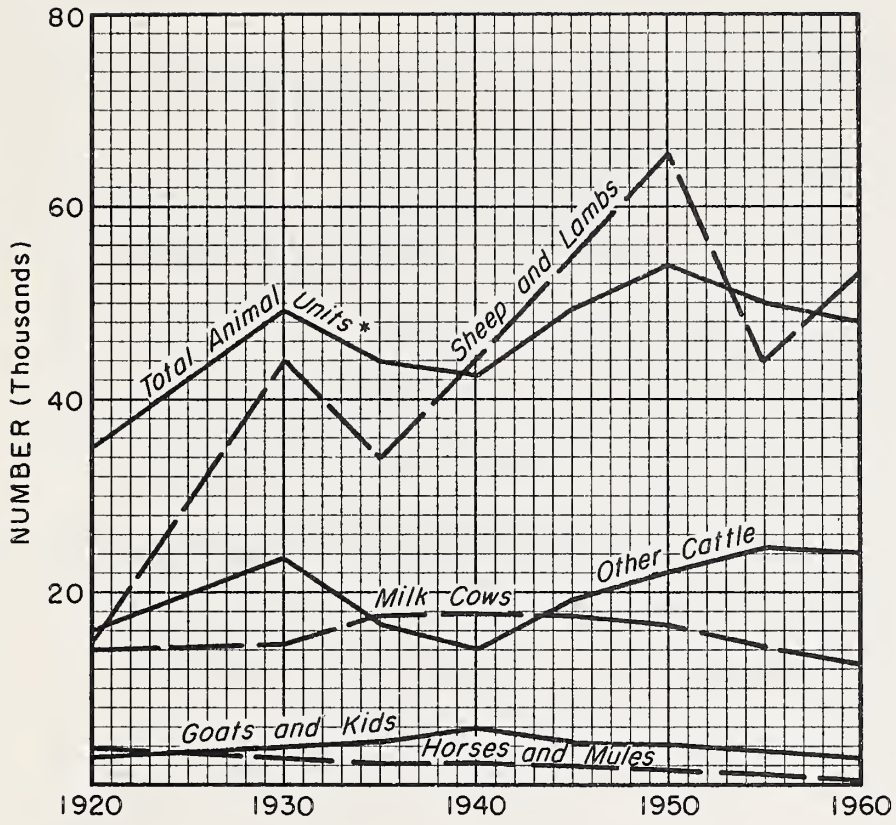
The net effect of adjustments in livestock numbers in Coos and Curry Counties since 1920 is shown in terms of animal units (fig. 16). Although total animal units have increased during the past 40 years, a definite cyclic pattern is apparent with peaks in 1930 and 1950 and troughs in 1940 and 1960. The drop in milk cow and sheep numbers was largely responsible for the reduction in animal units during the last 10 years.

Agricultural Income

Agriculture contributes to the economy of the basin in two ways. It provides income not only to farmers but also to the workers employed in the agricultural processing and manufacturing industries in the basin. Agricultural income from the sale of crop and livestock products in the basin in 1959 is estimated at about $6.8 million (table 24). In addition, over $1 million was derived from the sale of forest products from land operated by farmers.

Income from the sale of livestock products accounted for 78 percent of the agricultural income and crops accounted for 22 percent. Dairy products were the chief source of income, accounting for $3.3 million or 49 percent of the total. Bulbs and flowers were the most important crop sold accounting for $0.8 million. Almost all of the $499,000 listed as "fruits, nuts, and cranberries" was derived from the sale of cranberries.

Over 50 percent of the agricultural income in the basin was received by



Source: U.S. Census of Agriculture data for Coos and Curry Counties, Oregon.
**Factors used to convert livestock into animal units are: 1 cow = 1 AU, 1 sheep or goat = .2 AU, 1 horse or mule = .8 AU.*

Figure 16: Livestock numbers for two principal counties in the South Coast Drainage Basin, Oregon, 1920-1960.

Table 24.--Estimated agricultural income, South Coast Drainage Basin, Oreg. 1959

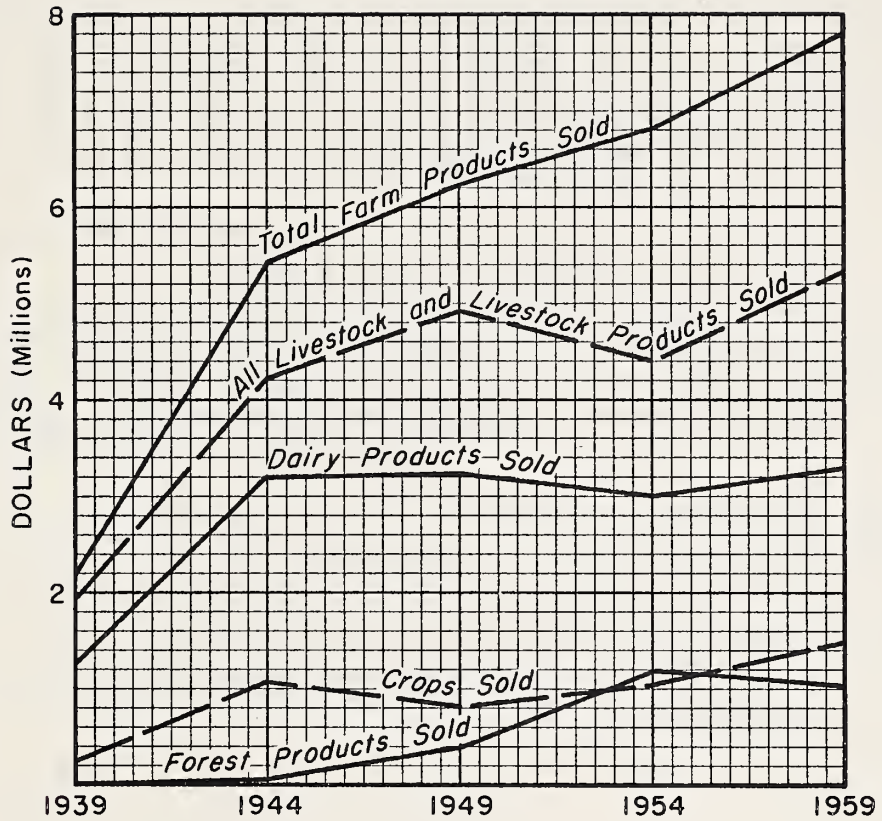
Commodity sold	Value of farm products sold				
	Subbasin				
	1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
	Thousand dollars	Thousand dollars	Thousand dollars	Thousand dollars	Thousand dollars
Dairy products	362	2,148	732	81	3,323
Poultry products	26	62	45	15	148
Cattle and calves	212	796	132	72	1,212
Sheep and lambs	169	105	3	82	359
Other livestock products	103	119	20	50	292
Total livestock products	872	3,230	932	300	5,334
Bulbs and flowers	16	5	1	788	810
Other horticultural specialties	15	48	34	48	145
Fruits, nuts, and cranberries	101	303	43	2	449
Other crops	5	65	12	2	84
Total crops	137	421	90	840	1,488
Total crops and livestock	1,009	3,641	1,022	1,140	6,822

Source: Based on data from U. S. Census of Agriculture and data from USDA Field Party survey (table 19).

farmers in the Coquille Subbasin, and the rest was distributed among the other subbasins in about equal amounts. Dairying was the most important source of agricultural income in the Sixes, Coquille, and Coos Subbasins while lily bulbs were the chief source of income in the Chetco Subbasin.

Total farm income in the basin has increased each census year since 1939 (fig. 17). The largest increase occurred from 1939 to 1944 and was a result of both higher production and higher prices for crops and livestock. Since 1944, total income from the sale of dairy products has remained about the same even though milk production has decreased by about 18 percent. The lower production has been offset by higher prices. The value of livestock and livestock products sold has increased because of a combination of more sheep and cattle production and higher prices for livestock products. The value of crops sold has increased somewhat since 1944 even though prices for the two main crops, cranberries and lily bulbs, have generally been lower. Prices for both of these crops have fluctuated widely from year to year.

The relative shifts in income between the various commodities sold are shown in table 25. Note that income from the sale of dairy products decreased from 56 percent of the total income in 1939 to 42 percent in 1959. The



Source: U.S. Census of Agriculture data for Coos and Curry Counties, Oregon.

Figure 17: Value of farm products sold for two principal counties in the South Coast Drainage Basin, Oregon, 1939-1959.

value of livestock and livestock products sold fluctuated but remained at around 25 percent of the total while the percentage of income from poultry products decreased. The percentage of farm income from horticultural specialties (lily bulbs) increased sharply from 1939 to 1944 and then decreased while the percentage of income from fruits, nuts, and cranberries has gradually increased. The value of forest products sold by farmers has rapidly become an important source of income to farmers.

Table 25.--Distribution of farm income by commodities sold, Coos and Curry Counties, Oreg., 1939-59

Commodity sold	Percentage distribution of farm income in Coos and Curry Counties, Oreg., by years				
	1939	1944	1949	1954	1959
	Percent	Percent	Percent	Percent	Percent
Dairy products	56	59	53	44	42
Other livestock and livestock products	27	17	25	20	24
Poultry	4	3	2	1	2
Total livestock products	87	79	80	65	68
Horticultural specialties	2	16	10	10	12
Fruits, nuts, and cranberries	3	4	2	6	6
All other crops	6	...	1	...	1
Total crops	11	20	13	16	19
Total crops and livestock products	98	99	93	81	87
Forest products	2	1	7	19	13
Total farm products	100	100	100	100	100

Source: Compiled from data from the U. S. Census of Agriculture.

Marketing

Marketing of agricultural products in the basin has been a problem in the past because of remoteness from major population centers and inadequate transportation facilities. The development of modern highways in recent years has improved the marketing situation, but the cost of shipping farm supplies in and farm products out continues to be a significant expense to the producer.

Milk produced in the Sixes, Coquille, and Coos Subbasins is sold to manufacturing and processing plants in the basin while most of the milk produced in the Chetco Subbasin is sold as Grade "A" milk to local consumers.

Most of the livestock is marketed in Portland by the producer or through livestock buyers in the basin. Smaller lots of livestock are often sold through the Bandon Livestock Auction.

Most of the cranberries are sold through a local Cooperative Association. Easter lily bulbs and cut flowers are sold through local buyers or by growers directly to florists and nurseries throughout the United States. Air express is often utilized in transporting this commodity.

Most of the other agricultural products raised in the basin are sold for local consumption and are marketed by the growers.

WATER USE FOR AGRICULTURE

The major agricultural uses of water in the South Coast Basin are for production of forage, cranberries, lily bulbs, and livestock. Except in a few local areas, there is an adequate water supply for consumption by livestock. The milk cows are raised in the valleys where water is plentiful, and the supply of water for range livestock from streams, springs, and seeps is ample in most areas.

Water from normal precipitation, however, is not adequate to sustain maximum plant growth throughout the growing season. The balance between normal precipitation and plant requirements is illustrated in figure 18. Note that there is a surplus of rainfall in the winter months when plant requirements are lowest and a deficit in the summer months when plant requirements are highest. Hence, to fully meet plant requirements it is usually necessary to irrigate from June through September.

Irrigated Acreage

It is estimated that about 9,340 acres were irrigated in the basin in 1961. About 8,480 acres, or 91 percent of the irrigated land, was pasture and/or hayland (table 20). The other irrigated crops consisted of 530 acres of cranberries, 290 acres of lilies, and 40 acres of other crops. Irrigation was practiced on 16 percent of the cropland pasture and all of the cranberries and lilies.

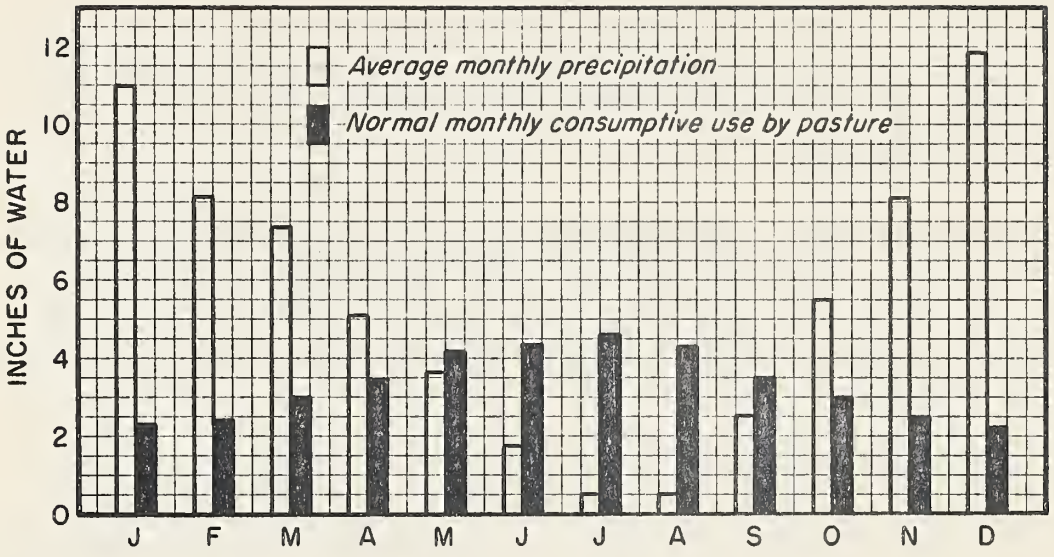
The majority of the irrigated acreage is in the broad valleys of the Coquille Subbasin (fig. 19). About 68 percent of the 9,340 irrigated acres is in this subbasin while 14 percent is in the Sixes Subbasin, 13 percent is in the Coos Subbasin, and 5 percent is in the Chetco Subbasin.

Water Rights

There are surface water irrigation rights for 8,081 acres and ground water rights for 197 acres (table 26). Most of the ground water rights are south of Brookings in the harbor area of the Chetco Subbasin. Wells in this area supply most of the water for the irrigation of lilies. In 1961, the estimated irrigated acreage exceeded the acreage with water rights in the Sixes, Coquille, and Coos Subbasins.

Source of Water and Method of Application

Streamflows are the major source of water for irrigation in the basin, and sprinkler systems are used almost exlusively for applying water to the land. Streams are the source of water for about 94 percent of the acreage irrigated, and wells are the sources for 2 percent (table 27). Other sources



Source: Irrigation Requirements, F. M. Tileston and J. W. Wolfe Stat. Bul. 500, Agr. Exper. Stat., Oregon State College, Corvallis, Oregon.

Figure 18: Average monthly precipitation and consumptive use of water by pasture, Bandon, Oregon.

Table 26.--Water rights and irrigated acreage, South Coast Drainage Basin, Oreg., 1961

Item	Subbasin 1 Sixes	Subbasin 2 Coquille	Subbasin 3 Coos	Subbasin 4 Chetco	Total
	Acres	Acres	Acres	Acres	Acres
Water rights 1/:					
Surface	929	5,367	1,205	580	8,081
Ground	...	31	...	166	197
Total	929	5,398	1,205	746	8,278
Acreage irrigated	1,300	6,390	1,210	440	9,340

1/ Source: Oregon State Water Resources Board.

Table 27.--Irrigation water source and method of application, South Coast Drainage Basin, Oreg., 1961

Item	Acreage irrigated: Subbasin 1 Sixes	Subbasin 2 Coquille	Subbasin 3 Coos	Subbasin 4 Chetco	Total
	Acres	Acres	Acres	Acres	Acres
Irrigation water source:					
Direct stream diversion	40	150	20	...	210
Pumped from streams	1,140	6,040	1,190	200	8,570
Pumped from wells	...	...	...	160	160
Other	120	200	...	80	400
Total	1,300	6,390	1,210	440	9,340
Method of application:					
Sprinkling	1,260	6,270	1,190	440	9,160
Flooding	40	120	20	...	180
Total	1,300	6,390	1,210	440	9,340

Source: USDA Field Party survey data (table 19).

include drainage water and water from sumps and holding ponds which may be fed by either ground or surface water. Sumps and holding ponds are used predominantly in conjunction with cranberry bogs. The bogs are usually located in marshy areas where the water level is close to the surface. Water accumulates in the small holding ponds and sumps adjacent to the bogs and is utilized for irrigation, frost control, and flooding prior to harvesting.

Pumps are the primary means of diverting water from its source to the land. In 1961, 92 percent of the land was irrigated by pumping from streams, 4 percent by pumping from other sources, 2 percent by pumping from wells, and 2 percent by direct gravity diversion. The wells are confined to the harbor

area in the Chetco Subbasin. Surface water is limited in this area, and most of the irrigation is dependent upon ground water.

About 98 percent of the land was irrigated by sprinkler systems in 1961. Sprinkler systems have proven to be better adapted to the area than flooding systems for several reasons. Since surface drainage is a problem, water control is an important factor, and the amount and distribution of water is better regulated by sprinkler systems than by flooding systems. Another factor favoring sprinkler systems is that the water supply is generally in large rivers with small gradients which makes gravity diversion difficult. Since most of the land is adjacent to the streams, pump irrigation is more practical than gravity diversion. Overflow on irrigated land during flood stages is another problem that is hazardous to ditches, diversions, and other structures associated with flood irrigation systems. It is also difficult to keep fields level enough for flood irrigation when overflow occurs on the land. In addition, sprinkler systems facilitate the control and efficient use of water by part-time farmers who of necessity cannot be present to make the frequent water changes required by flood irrigation.

Type of Irrigation Development

Almost all of the irrigation development in the basin has been accomplished on an individual farm basis. Of the 409 farms in Curry and Coos Counties reporting irrigation in the 1959 Census of Agriculture, only 5 farms with a total of 148 acres reported irrigation from mutual facilities.

Figure 20 Sprinkler irrigation of cranberries in the Sixes Subbasin.

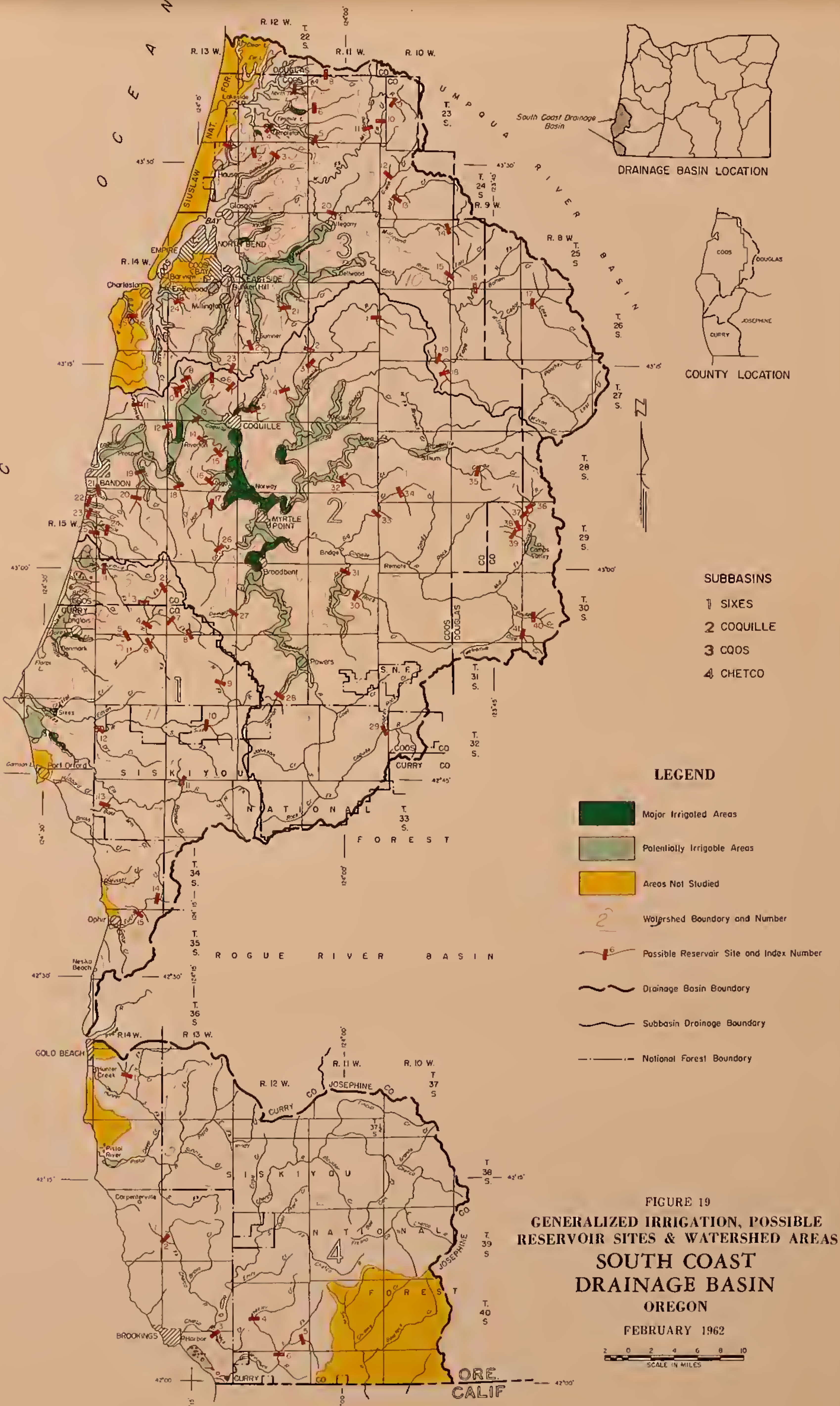


FIGURE 19
GENERALIZED IRRIGATION, POSSIBLE RESERVOIR SITES & WATERSHED AREAS
SOUTH COAST DRAINAGE BASIN
OREGON
FEBRUARY 1962

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Size of Irrigated Acreage

In 1959, irrigated acreage averaged 22 acres per irrigated farm. However, because of the large number of small tracts in cranberries and lilies, about 47 percent of the farmers reporting irrigation had 9 acres or less under irrigation (table 28).

Table 28.--Distribution of farms reporting irrigation by acreage intervals, Coos and Curry Counties, Oreg., 1959

Irrigated acreage distribution	Number of farms reporting irrigation	Percentage of farms reporting irrigation
	Number	Percent
1 to 9 acres	192	46.9
10 to 19 acres	61	14.9
20 to 29 acres	43	10.5
30 to 49 acres	53	13.0
50 to 99 acres	52	12.7
100 to 199 acres	6	1.5
200 to 499 acres	2	0.5
Total	409	100.0

Source: U. S. Census of Agriculture.

Cost of Irrigation

The latest data from the Census of Agriculture indicate that the costs of irrigation water to farmers in Coos and Curry Counties in 1949 were $9.34 and $7.34 per acre respectively. These costs include: (1) cost of electricity or fuel and oil used for pumping for irrigation and (2) costs of repairs, maintenance, and replacements for irrigation supply works and equipment (including the estimated value of any work done by the farm operator in repairs or maintenance). The interest on investment in equipment, depreciation, and the cost of farm labor for irrigating are not included in these figures.

Trends in Irrigation

Although irrigation has been practiced in the basin on cranberries and other miscellaneous crops for several years, it was not until after 1944 that it became a widespread practice (table 29). Irrigated acreage increased by over 4,600 acres in Coos and Curry Counties from 1944 to 1949 and has continued to increase since 1949 but at a slower rate. In 1939, about 6 percent of the farms in the basin reported irrigation compared to about 30 percent reporting irrigation in 1959.

Future Irrigation

Future irrigation development in the basin will be governed by several physical and economic factors. The two most important physical factors are the availability of suitable land and the availability of suitable irrigation water for this land. There are about 286,400 acres of land capability class-

Table 29.--Irrigated acreage, Coos and Curry Counties, Oreg., 1939-59

Year	Irrigated acreage		
	Coos County	Curry County	Total
	Acres	Acres	Acres
1939	1,373	...	1,373
1944	644	3	647
1949	4,382	923	5,305
1954	6,301	1,701	8,002
1959	7,419	1,554	8,973

Source: U. S. Census of Agriculture.

es I through IV in the basin (table 1). On the basis of soils alone, this is the amount of land that is generally susceptible to irrigation. However, only about 54,740 acres of this land is presently being used as cropland or cropland pasture. The rest is in timber, brush, swamp, and other noncropland uses.

Estimates obtained from the USDA reconnaissance survey of the basin indicate that there are about 24,700 acres of potential cropland that could be converted to cropland use in the future (table 30). Over half of this is in the Coquille Subbasin. It was also estimated that an additional 51,600 acres of land in the basin is so located that it could be irrigated. This includes both present dryland cropland and potential cropland. Data obtained in the survey indicates that natural streamflows would be adequate to irrigate about 32 percent of the potentially irrigable land.

Table 30.--Estimated present and potential cropland and irrigated land, South Coast Drainage Basin, Oreg., 1961

Item	Subbasin				
	1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
	Acres	Acres	Acres	Acres	Acres
Land in capability classes I-IV	29,500	97,750	111,250	47,900	286,400
Total cropland	7,890	33,750	10,540	2,560	54,740
Potential cropland	5,800	15,900	2,950	50	24,700
Irrigated land	1,300	6,390	1,210	440	9,340
Potentially irrigable land	9,300	30,600	10,000	1,700	51,600

Source: USDA, Soil Conservation Service and USDA Field Party survey data (table 19).

Two other problems of a physical nature that complicate irrigation development in the basin are drainage and flooding. These problems are covered in detail in the latter sections of this report, but it should be noted at this point that an area of about 28,900 acres is flooded annually in the basin, and about 35,000 acres of arable land has drainage problems. In many cases these two problems are present on potential cropland and potential ir-

rigable land.

It is apparent that physical opportunities for additional cropland and irrigation development exist in the basin. However, the degree to which this development occurs will depend on several economic factors. Agriculture is presently predominantly based on forage crops which sustain dairy and livestock production. Dairy and livestock products are the source of about 68 percent of the agricultural income; crops account for 19 percent; and forest products account for 13 percent. The comparative returns from the alternative crops and the relative costs to farmers for the various inputs required for production of these crops will determine future agricultural land and water use in the basin.

It is anticipated that forage production will continue to be the most important cropland use in the basin. Although there may be some increase in acreage of certain specialty crops already grown in the basin, no major shifts in cropping patterns are expected in the near future. Dairying and livestock operations are well established. Dairying requires major investments in specialized equipment which must be depreciated over a long period of time. Changing from dairying to other types of farms would entail considerable losses in present investments.

Another factor which discourages major changes in land use is the marketing situation. Markets for the existing crops and livestock are fairly well established. Changes in cropping patterns would require new marketing outlets. Because of distance to markets, the basin is in a less competitive position than other areas closer to population centers and marketing and processing plants. Thus, any development of additional cropland and irrigation will probably depend primarily on expansion of markets for products currently raised in the basin.

A comprehensive analysis would be necessary to determine the future economic returns from irrigation and the value of irrigation water. Such an analysis should consider several factors that as yet have not been appraised comprehensively. Among these factors are the following:

1. The combined effect on national requirements for agricultural products based on projected population growth, improved dietary standards resulting from higher levels of economic output per capita, and expected shifts in foreign exchange of agricultural products.

2. Shifts in economic advantage between regions of the country for production and marketing of major classes of agricultural products.

3. Growth of nonagricultural uses of the land and water resources, depletion of resources now used for agricultural production, retirement of inferior land from agricultural use, and the probable effects of these factors on availability of land for agricultural production.

4. Advancement in agricultural production technology resulting from research and educational and technical assistance pro-

grams, and the resulting increase in production and utilization of crops and pasture.

5. Opportunities for resource development with expected levels of agricultural output and costs.

An essential first step in analyzing the feasibility of water developments is the establishment of the current situation with respect to the agricultural use of the land and water resources as a means of identifying some of the problems involved, which in turn indicate opportunities for adjustments and improvements. The time limit imposed for the completion of this report has restricted the scope of material presented here to (1) the collection and analysis of historical data that could be oriented to or would be indicative of the current agricultural situation in the basin, and (2) an indication of some of the needs and opportunities for water resource development in the basin.

WATER RELATED PROBLEMS IN THE BASIN

WATER SUPPLY

The water resources of the South Coast Drainage Basin, in total, are more than adequate for present and future agricultural needs. This area of approximately 2,985 square miles has an average annual water yield of about 9 million acre feet after current consumptive use withdrawals. There are, however, certain local shortages, particularly during the August-September period of low water yield. There are also some potential problems of water quality.

The South Coast Basin has a highly uneven seasonal distribution of water yield since most of the precipitation falls between November and March. This problem is accentuated by low mountain elevations, which preclude the accumulation of a significant snowpack. The relative shortness of these coastal watersheds also hastens runoff. Extensive timber harvesting and clearing of land for agriculture has strengthened the tendency toward rapid runoff and consequently tended to decrease the amount of water temporarily detained and later released in seeps and springs.

Irrigation

Approximately 16,000 acre feet of water, or about 0.2 percent of the total annual yield, are needed during the irrigation season, June through September, to adequately meet the water requirements for the 9,340 irrigated acres. Water yield during this period is 900,000 acre feet, or about 10 percent of the total annual yield. Thus, it would appear that water supplies for the basin are adequate for irrigation. However, there are critical water supply problems in some areas. For instance, 7 of the 35 tributary watersheds studied have a water shortage at the present time (table 31). Most of these shortages occur in the smaller watersheds and in tidal areas where salt water from the ocean makes the river flow unusable.

There is an estimated 51,600 acres of potentially irrigable land in the South Coast Basin in addition to that presently irrigated. This is nearly six times the presently irrigated acreage. Thirty-one of the 35 tributary watersheds studied have additional land that could be irrigated. An estimated 100,000 acre feet of water, slightly more than one percent of the area's total water yield, would be needed for adequate irrigation of all presently irrigated and potentially irrigable land. However, due to yield variations by seasons and watersheds, there is sufficient natural flow to irrigate only about 32 percent of the additional irrigable acreage. It is apparent that the natural runoff of many of the streams would have to be supplemented with water stored in reservoirs during the wet seasons.

Local landowners have reported increased encroachment of salt water into the upper portions of the tidal estuaries. This may be due to increased upstream consumptive use depleting the streamflow and changing the balance between fresh and salt water in the tidal areas. The "salt front" may make further advances in the future as streamflows are further depleted depriving irrigated lands in the tidal areas of a suitable water supply at high tide.

Table 31.--Summary of tributary watersheds with inadequate irrigation water supply, South Coast Drainage Basin, Oreg., 1961

		Subbasin				
	Unit	1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
Tributaries studied	Number	11	5	13	6	35
Tributaries with water shortages	Number	2	3	1	1	7
Presently irrigated land with water shortages	Acres	70	1,280	100	140	1,590
Tributaries with inadequate water for potential irrigable land	Number	8	5	9	2	24
Potentially irrigable land needing water development	Acres	6,700	21,300	5,800	1,100	34,900

Source: USDA Field Party survey data (table 19).

Livestock

There is usually an adequate water supply for consumptive use by livestock in this area of abundant rainfall. In most areas, natural streams and springs provide an adequate supply without the need for additional development.

Forestry and Related Uses

Water requirements for forestry have been outlined in the "Forestry" section of this report. There are generally adequate water supplies to meet present requirements. Probably the greatest problem is maintenance of an adequate streamflow of proper quality to maintain and enhance fish life.

As human activity in forested watersheds increases, water quality problems may also increase. For instance, many of the forest campgrounds and picnic areas have water supplies from untreated streams and springs. These supplies can become polluted from heavier use of the watersheds above them if adequate precautions are not taken.

Large quantities of water may be needed for secondary wood manufacturing industries in the future. Reservoir storage will be needed to provide a dependable continuous supply for these industries in most of the South Coast Basin.

DRAINAGE

Approximately 73,000 acres, or 25 percent of the total arable soils in the South Coast Drainage Basin, are subject to excessive wetness. These figures are based upon a land capability inventory, as most of the area has not been surveyed. Much of the arable land that is subject to excessive wetness

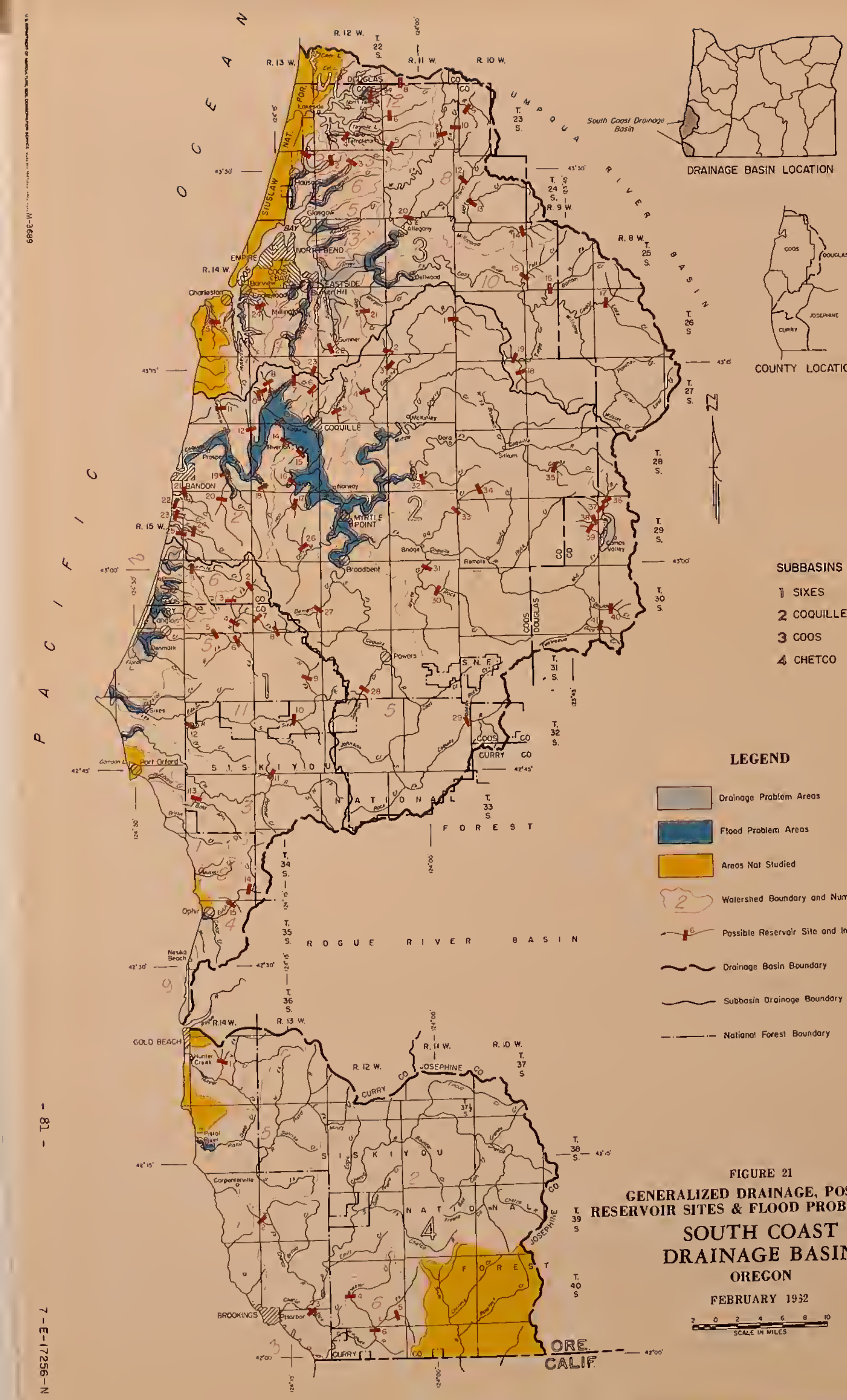

FIGURE 21

GENERALIZED DRAINAGE, POSSIBLE RESERVOIR SITES & FLOOD PROBLEM AREAS

SOUTH COAST DRAINAGE BASIN

OREGON

FEBRUARY 1962

SCALE IN MILES

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is being used, and will probably continue to be used, for timber production and other purposes that do not require drainage. It is estimated that 35,000 acres, or about 48 percent of the excessively wet soils, need to be drained. These areas are shown on the generalized drainage problems map (fig. 21). An estimate of the soils with excessive wetness and areas needing drainage by subbasins is shown in table 32. This table also shows the percentage distribution of excessively wet soils by subbasins.

Table 32.--Estimate of excessively wet soils and acres needing drainage within land capability classes I-IV, South Coast Drainage Basin, Oreg., 1961

	Subbasin				
	1 Sixes	2 Coquille	3 Coos	4 Chetco	Total
	Acres	Acres	Acres	Acres	Acres
I	...	...	...	...	...
II	1,300	500	1,000	200	3,000
III	900	33,500	22,500	100	57,000
IV	5,500	2,800	3,800	900	13,000
Total	7,700	36,800	27,300	1,200	73,000
Acres needing drainage	5,000	22,100	6,500	400	35,000
	Percent	Percent	Percent	Percent	Percent
Percentage distribution of excessively wet soils	11	50	37	2	100
Percentage distribution of acres needing drainage	17	63	19	1	100

Source: USDA Field Party survey data (table 19). Estimated acreage of land by capability class and subclass (table 1).

More than half of the excessively wet soils in the Sixes Subbasin are in land capability class IV, suitable for only occasional cultivation. The majority of the excessively wet soils in this subbasin are located on the tidal flats at the mouths of the tributary watersheds and in the Floras and Willow Creek areas (fig. 22).

Most of the excessively wet soils in the Coquille Subbasin are in land capability class III. They are predominantly along the main Coquille River below Myrtle Point.

The wet soils in the Coos Subbasin are predominantly along the sloughs and tidal areas of the streams in the vicinity of Coos Bay.

The Chetco Subbasin has a relatively small amount of excessively wet soils due to the steeper gradient of its streams. Drainage problems in the Chetco Subbasin are predominantly in the tidal areas.

Figure 22 Area on Floras Creek needing drainage. It is very difficult to improve these pastures without it, Sixes Subbasin, Oreg.

Seepage of water from higher ground causes excessive wetness on adjacent arable land in all subbasins (fig. 23).

WATER RELATED DAMAGES

Flood problems in the South Coast Basin result from a combination of natural factors and the management of the land. There is little doubt that floods, land slippage, and erosion occurred before settlement of the area. In some areas, the natural tendency toward flooding has been intensified by human activity while in other areas land has been reclaimed and used for agricultural or urban development.

There are two main sources of floodwaters in this area:

1. Rapid runoff of precipitation.

2. Inundation from ocean tidal action.

Floods are most likely to occur during the November to March heavy rainfall period but may occur as early as September or as late as May. Fairly continuous rainfall during this period causes the ground to become saturated within a few days; little of the precipitation is detained as snow, and due

Figure 23 This unimproved pasture on the Sixes River has a drainage problem due to water seepage from higher ground, Sixes Subbasin, Oreg.

to the steepness of the upper portions of most watersheds runoff is very rapid causing floods where the stream gradients are much flatter in the main river valleys. Past records show that major floods occur about every ten years.

Flooding by inundation from ocean tidal waters is common along the lower parts of the coastal watersheds. Damage occurs during periods of abnormally high tides, usually during severe winter storms. Dikes and tidegates have been installed to protect many areas, but some of these structures are inadequate or in need of repair. Many other areas are entirely without protection (fig. 24).

Flood damage has been particularly severe when high tides and heavy runoff occur similtaneously because then the runoff of floodwaters from lowland areas is seriously impeded. Drifting sand has partially blocked the outlet of some streams causing floodwaters to back up and flood lowland areas. This is a serious problem in the Floras Creek area in the Sixes Subbasin and in the North Slough area in the Coos Subbasin.

Figure 24 Typical unprotected, undeveloped tideland, South Coast Drainage Basin, Oreg.

Forested Watersheds

The most serious and far-reaching water related damages on forest land are those created by timber harvesting activities. Special precautions are required in this activity to prevent excessive damage to watersheds and resulting damage to downstream areas. Too often adequate precautions have not been followed, either because of a lack of knowledge and planning, or because of a lack of economic resources to afford desirable watershed protection.

Heavy timber harvesting has increased the risk of flood occurrence in many drainages. For instance, the acreage of private land logged between 1949 and 1960 was 250 percent of the acreage that would normally be logged during a 12-year period of a 90-year rotation. At the same time, the construction of forest access roads has progressed very rapidly. Thus, an abnormally large acreage has been exposed to the hazards of soil erosion, increased flood peaks, and water-carried logging debris. Thus, while faulty management practices are to blame for some watershed damage, much of the trouble is due to the large amount of activity taking place.

The reasons for heavy cutting of the timber resource are very complex. Involved are the economic strength of the individual land owners, the large demand for sawtimber in the area, and many other factors. Generally, the owners in the best economic position are those with large, consolidated

holdings and with a manufacturing plant capacity similar to the sustained-yield capacity of their land. In addition, most of the large private holdings, as well as the public lands, are managed by foresters trained to recognize forest watershed values. Owners of these lands are most likely to be harvesting their timber conservatively and protecting the watershed values at the same time.

Where ownerships within a drainage are intermingled, there has often been a lack of cooperation in development of a road system. Each owner has tended to proceed independently with road development and has been limited in the quality of road that he could construct because of a lack of economic resources. In turn, expensive road construction leads to heavy timber cutting as the owner attempts to recover his investment. The end result is often a logged off drainage with an abandoned substandard road system. Such drainages present an erosion and flood hazard and are an unfavorable setting for intensive management in the future. The public agencies are working continually to reduce these problems through cooperation with private owners in development of cooperatively financed road systems.

A further limitation to forest conservation is the large proportion of forest land in small individual ownerships. Many of these holdings are too small for efficient, profitable management on an individual basis. The owners usually lack the forestry training and experience needed to do an adequate job of managing their forest land and cannot afford to hire consultants. Many owners have only a casual interest in tree farming. For these reasons, much of the small private forest land is rather poorly managed. Often owners tend to liquidate their investment in timber and either sell the land or put it to other uses that may appear to produce greater profits in a shorter time.

The combination of severe winter storms and poorly planned and executed timber harvesting operations results in costly damage to forest land. The most tangible damage is that to roads. During one storm in November, 1961, an estimated $100,000 damage occurred to permanent forest access roads in the South Coast Basin. Storms of this type occur at about 5-year intervals. Less tangible, but perhaps more costly in the long run, is the loss of soil productivity resulting from soil erosion and earth movement.

Log and debris jams in streams are recognized as a major problem. They begin when unmerchantable logs and slash are deposited in streams or draws during logging and road construction (fig. 25). During high-water periods this material is washed downstream until it piles up against an obstruction to form a jam. Where extensive areas have been logged, the debris problem is particularly accute. As floodwaters are backed up behind small jams, flash floods are likely to develop. These begin in the headwaters of a drainage but build up rapidly to a size where they endanger life and property. It is common for a flash flood to scour out a channel to bedrock and increase its width as much as 50 feet. Downstream damage occurs when logs pile up against bridges and other improvements or are deposited on agricultural land. Debris also causes localized streambank erosion. Large jams may back up flood waters causing excessive flooding. Large, solid jams have accumulated at many points blocking the passage of migratory fish. Debris that reaches the bays and harbors is a serious menace to navigation.

Serious soil erosion is likely to occur as a result of road construc-

Figure 25 Logging debris accumulated in a draw is a potential source of log jams and related damage downstream, South Coast Drainage Basin, Oreg.

tion. Many roads are planned without adequate regard for accepted watershed management practices. During construction excavated material may be sidecast into streams or left where it will be carried away by floodwaters (fig. 26). There is little provision for drainage on many roads, and where culverts are provided, they often discharge directly onto raw fill slopes (fig. 27). Upon completion of logging many roads are abandoned without erosion control prevention measures being provided. Heavy winter rains of one season commonly wash deep gullies in the surface of dirt roads that are not properly drained. Use of dirt roads by hunters and other people with four-wheel drive vehicles during autumn wet weather periods compounds this problem.

Many areas in the Coast Range are susceptible to slow landslides. Road construction through these areas may aggravate this problem. In some areas winter landslides on newly constructed roads are so severe that some roads literally have to be "built twice". Large landslides are a serious danger to life and property. Seldom can slide areas be restored to productivity for growing timber.

Erosion problems also occur as a result of logging. Tractor logging on steep slopes is a particularly common source of erosion (fig. 28). During intense winter storms any type of logging activity is likely to result in

Figure 26 Improper road location and construction has resulted in excessive soil disturbance and erosion on a forest road in the Coos Subbasin.

Figure 27 Improper culvert installation has resulted in soil losses on this forest road in the Coquille Subbasin, Oreg.

Figure 28 An erosion hazard is created by tractor skidding on steep slopes, South Coast Drainage Basin, Oreg.

erosion problems. Landings located in draws result in an erosion hazard. Not only is there likely to be disturbance of the stream channel and accumulation of logging debris, but there is also the problem of converging skid trails concentrating surface runoff.

Mineral exploration and development results in severe watershed damage on forest land. Mineral production, with the exception of sand and gravel production, has been a distinctly marginal enterprise in this area for several years. However, exploration and sporatic development work have continued. Access roads to exploration sites and workings are often poorly constructed on very steep grades and without adequate drainage. These roads are infrequently used, seldom maintained, and usually abandoned without being erosion-proofed. Since most of the mineral exploration has been in highly erodable serpentine soil areas, the resulting soil erosion has been severe.

Stream channel damage has resulted from placer and dredge mining on some streams. Dredged stream channels are usually unsuitable for fish spawning. It is questionable whether the value of the minerals recovered is worth the resulting watershed damage.

Mixed Forest Land - Rangeland Areas

As has been mentioned, there are large upland watershed areas in the South Coast Basin that are used to some extent for livestock grazing. This land consists of natural prairies, forest land that has been cleared for grazing, and grazed forest and brush land. Often these three types of areas are intermingled with forest land that is not grazed. This mixed land use pattern results in serious land management problems. The hazards of clearing fires getting out of control and livestock running loose tends to discourage management for forestry on adjacent land.

Considerable erosion and land slippage have resulted where steep upland watersheds have been cleared for grazing. The native or planted grasses do not hold the soil effectively in areas of high rainfall. Repeated burning to control the encroachment of undesirable vegetation leaves the soil unprotected. However, chemical sprays are now more widely used for brush control, so the burning problem has lessened appreciably.

While additional recently cutover forest land is being converted to range, other sizable blocks of land that were grazed in the past are being abandoned. These areas usually become restocked with brush in a few years because a seed source is not available to provide stocking of desirable tree species. If more grazing land is abandoned in the future, there will be a great need for reforestation to restore it to a productive condition. Meanwhile, the longer this land is used for grazing, the more erosion takes place, runoff of precipitation becomes more rapid, and the productivity of the soil is gradually reduced.

Valley Areas

Floodwater damage is widespread in the valley floors of the South Coast Basin. The damage to agricultural land would be even more severe if this land were not used almost entirely for production of perennial forage crops. The inundation of lowland farm areas for periods of several weeks aggravates drainage problems, overloads drainage structures, and destroys pasture plantings. This type of damage is particularly serious along the Coquille River between Myrtle Point and Riverton in the Coquille Subbasin (fig. 29).

Arable land is lost in many areas through streambank erosion. Damage is most prevalent in the swifter portion of the streams, but there is also some damage in the main valleys, some of which is caused by tidal and wave action on banks and dikes. Federal cost sharing under the Agricultural Conservation Program for streambank protection in Coos and Curry Counties averages almost $9,000 per year, and at least an equal amount is spent by farmers for this work.

Sheet, gully, and rill erosion is not a very serious problem on arable land at present because most of this land is used for production of pasture, hay, and silage. The usual crops are perennial grasses and legumes which give the best protection from erosion. However, if crops that require annual plowing or cultivation were grown, erosion of arable land would be more serious during flooding.

Sedimentation and deposition of debris carried by floodwaters causes

Figure 29 Annually flooded cropland pasture in Coquille Subbasin, Oreg., 1961.

Figure 30 Sedimentation covering pasture land on Euchre Creek, Sixes Subbasin, Oreg.

serious damage to arable land (fig. 30).

While the overall rate of sediment production in the South Coast Basin is slow, it is quite high in some local areas. It is estimated that the sediment production hazard varies from 5 to 700 tons per square mile per year. Generally the streams in Curry County produce the most sediment due to more erodable soils and steeper stream gradients. Silt deposits left on farm land are damaging to perennial forage crops. Deposits are occasionally deep enough that they must be removed or the field plowed and reseeded. The removal of logs and other debris deposited by floodwaters can also be very costly. This debris damages fences, drainage ditches, and other improvements. Weed infestations are spread through seeds carried by floodwaters. Some livestock diseases can also be spread in floodwaters.

Streambed sedimentation is harmful to fish life both in the main streams and in the tributaries. Streamflow characteristics may be seriously altered, spawning beds ruined, and food sources reduced.

Man-made structures and improvements are also damaged by flooding of the valley areas. Most of the towns are located above ordinary flood stage, but larger floods have occasionally damaged lower-lying portions of Coquille and Myrtle Point. Some industrial plants in the Coquille area have to partially shut down production and remove motors and other equipment from lower floors during high water periods. Many farm buildings have been built on stilts to keep the floor level above high water to protect residents, pro-

Figure 31 Riverbank erosion undercutting farm buildings and fences, Sixes River, Sixes Subbasin, Oreg.

duce, and livestock. Undermining by streams damages roads, buildings, and fences (fig. 31).

The railroad through the Coquille Valley has been flooded several times with resulting damage from deposition of debris and softening of the roadbed. Many roads are closed for extended periods by high water. Road surfacing is damaged or washed away, drainage structures are damaged, and debris is deposited that is costly to remove. The removal of logs and other flood-carried floating debris from the rivers and harbors that are used for navigation is an annual expense. Navigation channels must also be dredged frequently to remove accumulated sediment deposits.

NEEDS AND OPPORTUNITIES FOR IMPROVED MANAGEMENT OF WATER AND RELATED LAND RESOURCES

WATERSHED MANAGEMENT

There is need for continuing maintenance and improvement of the condition of all tributary watersheds in the basin. In general, the best watershed conditions will prevail when all resources are managed in a manner that insures the optimum sustained production. The most important management items pertaining to forestry and agriculture are outlined in the following section.

Forested Watersheds

There is a definite correlation between profitable forest management and good watershed management. That is, in areas where forest management is profitable on a continuing, long-term basis, there will probably be good watershed management practices also. It is likewise true that good watershed management is beneficial to the forest landowner, but its benefits are even more important to the landowners in downstream areas. With 89 percent of the South Coast Basin being forest land, and much of this used for commercial timber production, it is important that profitable and intensive forest management be encouraged as a way to better watershed management.

Physically speaking, the South Coast Basin is favorable for profitable forest management. There is a large block of good quality forest land relatively accessible to strong markets for timber. Markets for wood for secondary manufacture are developing and increasing the possibility of intensive management of young timber stands. Good access to water transportation for forest products puts this area in a strong competitive marketing position compared to other areas in the Pacific Northwest.

There are many problems to be faced in conversion of the land and the forest industries from an old-growth timber economy to an intensively managed second-growth timber economy. While the milling capacity for large logs needs to be reduced, the markets for small logs, hardwood and low value softwood species, and for wood presently wasted in logging and milling operations need to be greatly expanded.

Well planned road systems will form a basis for future intensive management of forest land. There is a need for greater cooperation between private landowners in drainage-wide road development projects. Some notable cooperation between private owners and between public agencies and private owners has occurred in the past resulting in economical permanent road systems that produced a minimum of watershed disturbance.

There is a great need for means of encouraging better management of small private forest holdings. There are several current programs with this as an objective, but increased emphasis is needed in several phases of management including advice and assistance in reforestation of cutover land, help in setting up management plans for small forest holdings, help in incorporating good conservation practices in logging and road development plans, and advice in marketing of forest products.

There are sizable areas of logged-off or burned commercial forest land that need to be restored to timber production. Rehabilitation programs for logged-off areas should also include erosion control measures and stream channel debris clearance where practicable. The brush cover on old burned areas provides watershed protection, but restocking this land to commercial tree species will greatly increase its contribution to the economy and still provide watershed protection. More economical methods of brushfield reclamation need to be developed. Effective means of controlling wildlife damage to tree plantations on these areas are particularly needed. The Pacific Northwest Forest and Range Experiment Station of the U. S. Forest Service is currently studying these problems in southwestern Oregon.

There are other phases of forest land management where better information and improved technology are needed to facilitate better watershed management. One of the most important needs is for more precise information concerning the complex forest soils of the area. A cooperative soil survey of coastal Curry County has recently been completed. Surveys of this nature need to be extended to the remainder of the South Coast Basin.

All forest land managers and owners need to recognize more fully their responsibilities as watershed managers. Let us take the log jam problem as an example. This problem isn't going to be solved through a perpetual cleaning-out of the main river channels. By the time debris gets that far downstream it has usually done considerable damage. Rather, the problem should be solved where it begins on the individual timber harvesting operations. More careful planning of timber harvesting operations would alleviate much of the problem, and if streams and draws were cleared of debris when logging of an area was completed, very little debris would be left to be carried downstream. The cleanup work is an additional expense to the forest landowner, but is less than the value of downstream damage and the cost of removing debris from rivers and harbors. Similar reasoning can be applied to the erosion control problem on forest land, for a large part of the impact of soil disturbance on this land is felt on other land downstream.

Many forest landowners and managers are recognizing the inter-relationship of other forest land values with timber production. There is, for instance, increased awareness of the correlation between healthy watershed condition and a thriving fish population, and between conservative timber cutting practices and enhanced recreational and wildlife values. There should be increased cooperation between forest landowners and the general public so that the optimum benefits from all forest values may be realized.

Mixed Forest Land - Rangeland Areas

Some of the more serious erosion problems in the basin are on the mixed forest-rangeland areas. Most of these areas are in poor condition for both range and forest because these are often conflicting uses. Over grazing and winter grazing are quite common on the coast because of mild winters and high cost of other feeds.

To realize the maximum benefits from this land and to prevent is depletion from accelerated erosion as well as prevent downstream flood and sediment damage, it is important that some programs and management practices be continued or initiated.

The land should be put to a use that is within its capabilities for sustained production. In this basin, most land in capability classes VI thru VIII is best suited to forest. Where practicable, forested land should be protected from grazing that conflicts with the production of wood products or endangers watershed values.

The areas that are suited to range use need more intensive development in the form of reseeding to selected adapted grasses and legumes and removal of encroaching woody plants that produce little forage but compete for space, moisture, and soil nutrients.

In many cases, livestock can be managed to encourage an increase in the vegetative cover and total forage production through rotation grazing and by deferred grazing during winter months. Grazing should never deplete the ground cover to a point where protection of the watershed and maintenance of desirable vegetation is impaired.

Agricultural Land

Watershed management practices are important on arable lands that are cultivated or used for perennial forage crops. There is a continuing need for conservation cropping systems together with erosion control practices, improved irrigation, and drainage measures. Many native and marginal hay and pasture fields should be replanted to better adapted species of grasses and legumes and managed for increased production. A summary of needed measures directly related to water follows.

Irrigation. It has been previously stated that most of the irrigation in this basin is accomplished by the sprinkler method which is the best to use under the existing circumstances. However, even with the best designed sprinkler systems better water management can be gained by giving careful attention to the amount and frequency of water application. Both sould be adapted to the soil, crop, rate of water application, and weather. The technical advisor and the farmer are in need of more factual information on water-holding capacity of the soils and their intake rates to facilitate more efficient use of water. In some areas where the water supply is continuous but not large in quantity, overnight holding ponds can be built to conserve the water, allowing it do accumulate until there is a large enough quantity to use. This is done to some extent in the harbor area (fig. 32).

Drainage. Approximately one-fourth of the arable land in the basin is subject to excessive wetness. One-half of this land, or about 35,000 acres, needs drainage for maximum production in its present use. Drainage would significantly increase the production on this land and would also increase the number of species and variety of crops that could be grown. In some cases, the water drained from the land might be used for irrigation. Drainage can be accomplished in many cases by the use of simple interception drains, however, most of the area requires extensive pattern or random drainage systems.

Many areas are subject to frequent overflow. Such areas often need to be protected by dikes and outlet drain ditches equipped with floodgate structures to prevent high water from causing reverse flows that add to the drainage problem. The same type of installations are needed on the tide

Figure 32 Overnight holding reservoir for irrigation where water supply is limited in the harbor area, Chetco Subbasin, Oreg.

Figure 33 Automatic floodgate on Coquille River Fishtrap Drainage District near Arago, Coquille Subbasin, Oreg.

lands (fig. 33).

There are many dikes, tidegates, floodgates, pumping plants, drainage ditches, and tile lines already in operation in the basin, but most of the land and crops would benefit from additional protection from both surface and subsurface water.

Erosion Control. Erosion on cultivated land is mainly of three types, (1) the cutting away of fields by streambank erosion, (2) water washing away soil from unprotected fields by rill and sheet erosion, and (3) wind erosion in some unprotected fields.

There is need for more stream channel work including removal of gravel bars, drift and brush; and dredging in the lower parts of the larger streams. River banks in many places need more protection by the use of rock, trees, brush, and natural growing vegetation (fig. 34). This type of channel work should often be done by groups as several people may be benefited.

Figure 34 Myrtle trees anchored to the Sixes River bank for bank protection, Sixes Subbasin, Oreg.

Most of the arable land is effectively protected from rill and sheet erosion by the growing of perennial sod forming crops. However, when such a crop is plowed for re-establishment or replacement by annual crops, care should be taken to insure that the soil is protected during the months of high precipitation and overflow. This can be done by careful selection of the time of working the fields and planting or by the use of good well-estab-

lished winter cover crops.

Wind erosion is not a serious problem at the present time because most cultivated land is either wet or heavy enough to resist wind action, or it is protected from the wind by trees or by hills. However, wind erosion could become more serious if large tracts of land near the ocean were cleared and put under cultivation. Some of the loess soils are especially susceptible to blowing. The best protection for these soils is to maintain windbreaks on the windward sides of the fields. Also, the soils should be protected as much as possible by maintaining good vegetative cover.

WATER DEVELOPMENT

It has been stated that about 51,600 acres of land could be irrigated in the basin in addition to the 9,340 acres presently irrigated. There is ample water available for development in the basin to irrigate this land.

Ground Water

Ground water is being used to a limited extent mostly in the harbor area of Curry County. In 1961, about 165 acres were irrigated by water from wells. Other sources of ground water include sumps, springs, and seeps. However, these sources are limited and, in some cases, have not been successful in this area. Wells have also often proven to be undependable both as to quantity and quality of water.

Surface Water

While many streams still have a dependable surface water supply available for present use during the irrigation season, there are also many that do not. Usually those that have additional arable land close by are the ones that are in the "do not" group.

Storage

The conservation of excessive, often damaging, runoff water in reservoirs for protection from floods and subsequent use for irrigation, industrial, domestic, recreation, and fish has considerable potential in the basin.

Many large reservoir sites have been proposed and studied in the past. Although none have been constructed to date, undoubtedly some will be in the future as needs increase and economic conditions improve. Almost all new reservoirs can, and should be, developed for multipurpose use considering all potential uses and benefits to be gained from storing the water. There is also a definite potential for medium sized upstream reservoirs. Table 33 summarizes reconnaissance data assembled by the U. S. Department of Agriculture on 87 sites that appear to have some merit and warrant future consideration. The location of these sites are shown on the index maps (figs. 19, 21 and 35).

There are no sizable group irrigation projects in the basin at the present time, but it appears that any major increase in irrigation in the basin will of necessity be done by groups rather than individuals.

Table 33.--Reconnaissance data on some reservoir sites, by subbasins, South Coast Drainage Basin, Oreg., 1962

Subbasin Number and name	Stream Name	Reservoir index Number	Map index Number	Drainage area Sq. mi.	Annual yield Acre ft.	Storage Acre ft.	Surface area Acres	Fill + storage Cy/ac.ft. 1/	Possibilities Uses 2/
1. Sixes.....	Fourmile Creek	6	1	15.1	43,500	6,900	249	16	I,F,R
	North Fork Floras Creek	5	2	2.3	6,600	940	35	95	I,F,R
	Do.	5	3	6.3	18,900	930	44	49	I,F,R
	Do.	5	4	24.7	73,600	2,770	135	37	I,F,R
	Floras Creek	5	5	49.6	148,000	1,650	65	59	I,F,R
	North Fork Floras Creek	5	6	41.5	124,000	1,160	60	59	I,F,R
	East Fork Floras Creek	5	7	12.0	35,700	990	44	86	I,F,R
	Do.	5	8	7.3	21,800	4,530	142	95	I,F,R
	North Fork Sixes River	11	9	7.0	20,700	4,000	152	42	I,F,R
	Sixes River	11	10	39.4	117,600	31,490	713	13	I,F,R
	Butler Creek	3	11	3.8	11,400	870	31	127	I, R
	Dry Creek	11	12	15.9	47,400	450	56	35	I, R
	Bald Mountain Creek	3	13	9.8	29,100	250	17	79	R
	Euchre Creek	4	14	13.8	41,100	750	35	78	R
	Do.	4	15	20.5	61,100	5,190	162	40	I,F,R
2. Coquille.....	Fruin Creek	4	1	3.2	8,600	660	31	173	R
	Woodward Creek	4	2	2.6	6,400	370	35	141	R
	Unnamed Creek	4	3	0.6	1,500	700	32	146	I,F,R
	Steele Creek	4	4	1.3	3,100	500	46	123	I,F,R
	Caufield Creek	1	5	1.7	4,100	120	116	109	I,F,R
	Beaver Creek	2	6	1.4	2,600	1,040	62	99	I,F,R
	Do.	2	7	4.0	7,800	1,850	184	29	I,F,R
	Intermittent Creek	2	8	2.5	4,900	1,570	98	68	I,F,R
	Not Named	2	9	0.7	1,300	310	39	97	I,F,R
	Not Named	2	10	0.5	900	120	25	116	I,F,R
	Sevenmile Creek	2	11	2.2	4,100	790	47	39	I,F,R
	Hatchet Slough	2	12	1.8	3,500	120	33	131	I,F,R
	Not Named	2	13	0.6	1,100	500	69	68	I, R
	Fat Elk Creek	2	14	2.2	4,200	440	72	54	I,F,R
	Pulaski Creek	1	15	1.5	2,800	180	31	82	I,F,R
	Fishtrap Creek	1	16	4.7	9,000	180	47	60	I,F,R
	Hall Creek	1	17	6.5	12,500	1,500	75	124	I,F,R
	Lampa Creek	2	18	4.7	9,100	310	56	75	I,F,R
	Bear Creek	2	19	22.1	42,400	3,630	399	21	I,F,R
	Bill Creek	2	20	6.0	11,600	1,200	60	59	I,F,R
	Johnson Creek	2	21	4.0	7,700	440	44	62	I,F,R
	Crooked Creek	2	22	2.4	5,300	1,200	81	197	R
	China Creek	2	23	35	7,600	1,990	199	99	I,F,R
	Twomile Creek	2	24	8.4	22,700	370	65	58	I, R
	South Twomile Creek	2	25	4.4	12,000	600	93	55	I,F,R
	Ward Creek	1	26	4.0	7,600	1,730	65	106	I,F,R
	Dement Creek	5	27	6.1	22,800	1,170	62	44	I,F,R
	Salmon Creek	5	28	15.9	44,100	3,440	122	68	I,F,R
	Coquille River	5	29	22.0	63,400	2,050	205	14	I,F,R
	Rock Creek	3	30	36.6	105,500	8,050	265	33	I,F,R
	Myrtle Creek	3	31	69.6	134,000	500	53	76	I, R
	Elk Creek	4	32	13.1	25,100	1,780	118	32	I,F,R
	Big Creek	3	33	5.4	10,300	1,500	62	121	I,F,R
	Do.	3	34	7.5	14,400	1,310	41	72	I,F,R
	Camas Creek	4	35	7.6	10,500	2,030	72	146	I,F,R
	Coquille River	3	36	6.3	9,700	17,380	396	64	I,F,R
	Long Creek	3	37	1.8	2,800	600	47	43	I, R
	Deep Creek	3	38	3.5	5,400	200	33	121	I, R
	Reed Creek	3	39	0.8	1,200	320	27	148	I, R
	Boulder Creek	3	40	7.2	10,700	1,500	75	91	R
	Dice Creek	3	41	3.7	5,500	290	20	88	R
3. Coos.....	North Slough	9	1	1.9	3,700	660	83	52	F,R
	Do.	9	2	2.0	5,400	260	44	80	F,R
	Palouse Creek	3	3	5.3	14,000	620	62	70	F,R
	Adams Creek	12	4	2.0	5,200	410	75	46	I,F,R
	Johnson Creek	12	5	6.4	16,900	160	36	49	R
	Benson Creek	12	6	5.7	15,300	1,430	112	46	I,F,R
	Noble Creek	12	7	3.6	9,100	2,980	168	51	I,F,R
	Big Creek	12	8	3.7	11,200	50	20	138	R
	West Fork Millicoma River	8	9	7.8	23,200	1,930	103	18	F,R
	Elk Creek	8	10	4.0	12,000	2,820	100	23	F,R
	West Fork Millicoma River	8	11	17.7	52,800	5,650	177	37	F,R
	Glenn Creek	8	12	11.0	32,800	8,190	256	48	F,R
	Matson Creek	8	13	11.7	35,000	8,790	275	25	F,R
	East Fork Millicoma River	8	14	7.8	21,500	4,180	131	59	F,R
	Fall Creek	10	15	14.8	41,200	4,960	157	59	F,R
	Bottom Creek	10	16	16.0	47,600	310	39	73	R
	Cedar Creek	10	17	28.5	85,000	1,050	218	10	R
	Tioga Creek	10	18	13.8	38,200	1,260	47	83	R
	Do.	10	19	2.3	6,400	2,430	91	88	R
	Marlow Creek	8	20	6.9	20,500	280	50	76	R
	Daniels Creek	10	21	4.3	12,800	1,990	100	85	I,F,R
	Boone Creek	1	22	1.8	4,900	540	79	30	I, R
	Noble Creek	4	23	1.9	3,600	190	19	142	I,F,R
	Joe Ney Slough	11	24	1.6	3,100	680	69	54	F,R
	Big Creek	X	25	2.9	5,500	4,060	203	34	I, R
4. Chetco.....	Conn Creek	4	1	1.4	4,200	350	17	213	R
	North Fork Chetco River	2	2	2.4	7,100	770	29	133	R
	Jack Creek	2	3	8.5	25,400	3,980	193	34	I, R
	Wheeler Creek	6	4	8.4	25,100	800	31	121	R
	Fourth of July Creek	6	5	7.5	22,500	860	27	120	R
	East Fork Winchuck River	6	6	20.9	62,400	6,580	219	30	R

1/ A comparative figure derived from dividing the estimated earth fill in cubic yards by the estimated water storage capacity in acre feet.

2/ I-irrigation, F-flood protection, R-recreation--fishing, hunting, and boating.

Source: Based on a survey by the U. S. Dept. of Agriculture Field Party.

OPPORTUNITIES FOR WATERSHED PROTECTION AND FLOOD PREVENTION PROJECTS

The Watershed Protection and Flood Prevention Act, Public Law 566, as amended, authorizes the Secretary of Agriculture to cooperate with local organizations in planning and carrying out works of improvements for flood prevention and/or for the conservation, development, utilization, and disposal of water in watershed or subwatershed areas smaller than 250,000 acres. The act provides for technical, financial, and credit assistance by the U. S. Department of Agriculture to landowners, operators, and other people living in small watersheds. Project-type action under the act is intended to supplement other soil and water conservation programs and other programs for the development and flood protection of major river valleys.

The U. S. Department of Agriculture is interested in knowing the general potential for P. L. 566 work as a guide to long range planning and coordination of possible future projects. Therefore, a preliminary review of 35 small watersheds having significant arable land was made to gather basic water and land use facts. A summary of this reconnaissance data is presented in tables 19A through 19E. The boundaries of these watersheds are shown on figures 19, 21, and 35. Watersheds have been designated by index numbers which are keyed to the tables.

Many of the water and related land resource problems of the South Coast Drainage Basin are of a type applicable to P. L. 566 work. However, under existing conditions and laws it appears that the solution of these problems may be practical and economical in only a few watersheds at this time. The field party's findings, indicating which watersheds have problems that appear to have the best possibility for P. L. 566 action, are presented on figure 35 and summarized in table 34.

Table 34.--Summary of watersheds included in reconnaissance, South Coast Drainage Basin, Oreg.

Subbasin and watershed	Project possibilities under P. L. 566
1. Sixes Subbasin:	
1. Brush Creek	A project does not appear feasible under existing conditions and laws.
2. Croft Lake	A project involving drainage, irrigation, and flood control might prove feasible.
3. Elk River	A project does not appear feasible under existing conditions and laws.
4. Euchre River	A project does not appear feasible under existing conditions and laws.
5. Floras Creek	A project involving drainage, flood control, and irrigation appears to be feasible.

Table 34.--Summary of watersheds included in reconnaissance, South Coast Drainage Basin, Oreg. (continued)

Subbasin and watershed	Project possibilities under P. L. 566
6. Fourmile Creek	A project involving drainage, flood control, and irrigation appears to be feasible.
7. Hubbard Creek	A project does not appear feasible under existing conditions and laws.
8. Mussel Creek	A project does not appear feasible under existing conditions and laws.
9. Nesika Beach	A project does not appear feasible under existing conditions and laws.
10. New Lake	A project involving drainage, flood control, and irrigation might prove feasible.
11. Sixes River	A project does not appear feasible under existing conditions and laws.
2. Coquille Subbasin:	
1. Central Coquille River	A project does not appear feasible under existing conditions and laws, but some areas in and near the Fat Elk, Fish Trap, and Norway Drainage Districts appear to be feasible.
2. Lower Coquille River	A project does not appear feasible under existing conditions and laws, but some areas do appear to be feasible such as Bear Creek, Coaledo Drainage District, Beaver Slough Drainage District, and Iowa Slough Drainage District.
3. Middle Fork Coquille River	A project does not appear feasible under existing conditions and laws, but some areas such as Camas Valley might be feasible.
4. Northeast Fork Coquille River	A project does not appear feasible under existing conditions and laws, but some areas might be feasible.
5. South Fork Coquille River	A project does not appear feasible under existing conditions and laws, but some areas might

Table 34.--Summary of watersheds included in reconnaissance, South Coast Drainage Basin, Oreg. (continued)

Subbasin and watershed	Project possibilities under P. L. 566
5. South Fork Coquille River (continued).....	be feasible.
3. Coos Subbasin:	
1. Catching Slough.....	A project involving drainage and irrigation might prove feasible.
2. Coalbank Slough.....	A project involving flood control, drainage, and irrigation appears to be feasible.
3. Haynes Inlet.....	A project involving flood control, drainage, and irrigation appears to be feasible.
4. Isthmus Slough.....	A project does not appear feasible under existing conditions and laws.
5. Kentuck Slough.....	A project involving flood control, drainage, and irrigation might be feasible.
6. Larson Slough.....	A project involving flood control, drainage, and irrigation might be feasible.
7. Lower Coos River.....	A project does not appear feasible under existing conditions and laws.
8. Millicoma River.....	A project does not appear feasible under existing conditions and laws.
9. North Slough.....	A project involving flood control, drainage, and irrigation appears to be feasible.
10. South Fork Coos River.....	A project does not appear feasible under existing conditions and laws.
11. South Slough.....	A project does not appear feasible under existing conditions and laws.
12. Tenmile Lake.....	A project involving drainage, irrigation, and flood control might prove feasible.
13. Willanch Slough.....	A project involving flood control, drainage, and perhaps irrigation appears to be feasible.
4. Chetco Subbasin:	

Table 34.--Summary of watersheds included in reconnaissance, South Coast Drainage Basin, Oreg. (continued)

Subbasin and watershed	Project possibilities under P. L. 566
1. Cape Ferrelo	A project does not appear feasible under existing conditions and laws.
2. Chetco River	A project does not appear feasible under existing conditions and laws.
3. Harbor Area	A project involving municipal, domestic, and irrigation water might prove feasible.
4. Hunter Creek	A project does not appear feasible under existing conditions and laws.
5. Pistol River	A project does not appear feasible under existing conditions and laws.
6. Winchuck River	A project does not appear feasible under existing conditions and laws.

A discussion and comparison of some of the small watersheds that appear to have the best possibilities for improvement under P. L. 566 follows. Others may also have possibilities for improvement under this law, but additional data is necessary before any conclusions can be reached.

Sixes Subbasin

Subbasin 1, the Sixes, includes almost all of Curry County north of the Rogue River Basin and also a small tract of southern Coos County extending through the Fourmile watershed. It includes a group of small creeks and rivers flowing directly into the Pacific Ocean. For the purpose of this study the subbasin was divided into 11 watersheds (table 19A and figs. 19 and 21). Reconnaissance studies indicate that two of these watersheds, Floras Creek and Fourmile Creek, have greater possibilities for improvement through P. L. 566 under present conditions and laws than the others.

Floras Creek, Watershed Number 5. Floras Creek watershed is about 20 miles long and contains 57,580 acres ranging in elevation from sea level to about 2,400 feet. This watershed has the largest flood and drainage problem areas of any watershed in the Sixes Subbasin (table 19A). Also, it contains the largest arable coastal plain area in Curry County.

About 1,500 acres of pasture are subject to flooding, and 2,000 acres of arable land are excessively wet. The flooding and drainage problems are aggravated by ocean driven and wind blown sand blocking the outlet of Floras Creek. Dune stabilization near the ocean might help to improve conditions of the creek outlet. Also, it might be possible to develop a permanent outlet that would provide adequate flood control and drainage. However, im-

proving the outlet might lower the level of the lakes near the ocean which are used for boating, hunting, and fishing. Increasing the capacity of the stream channel through the agricultural areas together with streambank protection will help reduce flood damage on agricultural land.

An alternate method of protecting and improving the flooded and wet lands in the area would be the use of low dikes and automatic drainage or tide gates perhaps supplemented by low-head pumping plants. Dikes and gates would delay winter flooding of certain areas, and pumps would permit earlier use in the spring and later use in the fall. A further advantage of pumping would be the lowering of the water table within diked areas at the time the water level in the exterior drains and channels remain high during the growing season.

There are over 2,500 acres of arable land of which only about 383 acres are presently irrigated. If all the arable land were irrigated, it would be necessary to store water to serve an estimated 1,700 acres. Water storage would reduce flooding, erosion, and drainage problems and would benefit irrigation, wildlife, and recreation. Seven reservoir sites (table 33) have been located in the Floras Creek watershed.

Part of the upper watershed is composed of steep land which has been cleared for grazing. Much of the forest land in this watershed has been logged. In some places there are serious erosion problems due to washing and slippage. The deposition of sediment and debris carried from the upper part of the watershed is a source of damage to agricultural land in the area. Land treatment work such as reforestation and erosion control would help to reduce this damage.

Fourmile Creek, Watershed Number 6. This watershed is much smaller than Floras Creek being about ten miles long with an area of 14,300 acres. It varies in elevation from sea level to about 1,500 feet.

There is considerable upland erosion resulting from overgrazing of land that is best suited for forest. There is also considerable streambank erosion and sediment deposition. However, the acreage with flooding problems is relatively small compared to Floras Creek (table 19A).

There are 1,300 acres needing drainage, and almost 1,700 acres could be irrigated. About 1,000 acres would require stored water in order to be irrigated. One reservoir site has been located that might furnish all of the water needed. This site is shown as number 1 on figures 19 and 21 and in table 33.

Other Watersheds. Two other watersheds in this subbasin, Croft Lake, number 2, and New Lake, number 10, are worth noting. Both are areas draining into the same fresh water lakes as Floras and Fourmile Creeks. They are small and lie between Floras Creek and Fourmile Creek. They both have considerable land needing drainage and flood protection. Both also have considerable arable land that might be improved and irrigated (table 19A). Some storage would be required in order to irrigate all of the irrigable land. No likely reservoir sites were found on these streams. However, water stored on either Floras Creek or Fourmile Creek could be diverted to these watersheds. It is possible that a project combining all four of these watersheds

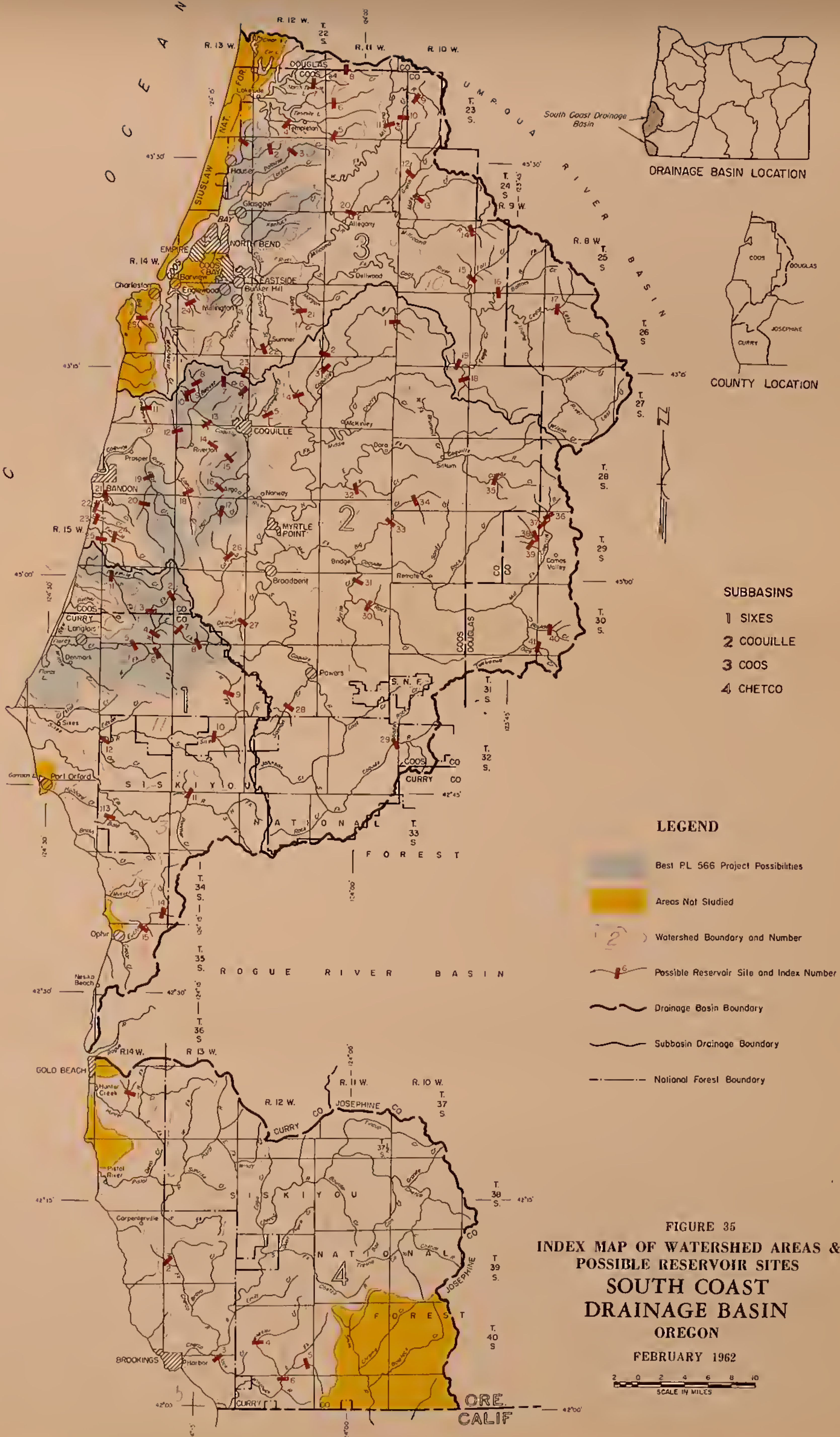

FIGURE 35
INDEX MAP OF WATERSHED AREAS & POSSIBLE RESERVOIR SITES
SOUTH COAST DRAINAGE BASIN
OREGON
FEBRUARY 1962

M-3689

7-E-17255-N

under P. L. 566 might show increased benefits.

The Elk River, number 3, and Sixes River, number 11, should be mentioned as data from the survey (table 19A) indicate that considerable benefits could be derived from correcting the existing problems. Both have extensive erosion, drainage, flooding, and irrigation problems that might be suitable to P. L. 566. However, it is felt that due to the size of these streams and quantities of water involved the benefits would not presently be large enough to offset the cost of needed improvements.

Coquille Subbasin

Subbasin 2, the Coquille, includes all of the Coquille River. It is mostly in Coos County except for the upper portion of the Middle Fork and its tributaries which are in Douglas County. In addition to the Coquille River, subbasin 2 includes about five small coastal creeks that flow directly into the Pacific Ocean. For the purpose of this study, the subbasin was divided into five watersheds because of the limitation of time and information on some of the smaller tributaries.

This subbasin embodies a major portion of the agricultural potential of the basin. The problems of agriculture associated with water are also perhaps more difficult to solve than in the other subbasins. The Coquille River has a larger drainage area and flatter grade than the other streams in the basin and, consequently, has more severe flooding problems.

Data gathered by the USDA Field Party on the five watershed areas outlined on figures 19 and 21 and in table 19B indicate that many benefits could be accrued by solving the water problems connected with drainage, flood control, irrigation, and erosion control; but the five areas are so large and so located that each one involves such large quantities of water that needed structural measures would be very costly. However, all of these watershed areas have smaller tributary areas that appear to have some possibilities for partial protection and irrigation development combined. Time did not allow detailed examination of such areas individually, however, the over-all study has brought out some significant facts that are worth noting.

The Coquille River and its larger tributaries have developed high banks from the sedimentation accompanying frequent overflows. These banks in many places are seven feet higher than the average land elevation a few hundred feet away from the river thus forming natural dikes. While these dikes prevent overflowing from smaller floods, they do not prevent overflowing from the frequent larger floods. They then prevent the imponded water from returning to the channel. Smaller side tributaries continue to contribute water for weeks at a time. Such prolonged flooding is not only detrimental to crops but also limits the selection of crops that can be grown.

Flood problems could be partially corrected in many areas along the river where individuals, drainage districts, and other groups can isolate themselves from all but major floods by natural barriers or dikes. Most of the same areas also need more water for irrigation. The side tributary streams have some reservoir sites many of which are listed in table 33 and on figures 19, 21, and 35. Development of such storage would have the effect of reducing the water that must be released through the tide and flood gates

as well as increasing the water supply and streamflow during the months of shortages. Dikes and river banks need protection from undercutting in many areas and building up in the lower places. The tide and flood gate capacities in almost all areas need enlargement as do the drain and water storage ditches that lead the water to them. Pumps may need to be installed where there are significant tracts of land that are extremely low in relation to the normal winter water level of the river. Two drainage districts, Beaver Slough and Fat Elk, have already installed pumps. It would not be economically feasible to design these pumps to give complete protection from all storms and floods. However, they can be designed, built, and operated to reduce the frequency and length of time that the land is flooded in the spring and fall, thus increasing the length of growing season for the crops invloved.

A few of the areas observed where such a plan might prove feasible under P. L. 566 are noted below.

Beaver Slough Drainage District. This is an area of 1,737 acres along the river from Coquille to Beaver Slough where some flood gates, dikes, and pumps have already been installed. There is an additional relatively undeveloped area of around 800 acres of potentially arable land lying along the slough and Beaver Creek to Coaledo that might be included in this tract. Five reservoir sites have been studied that have some merit on the small tributaries draining into this area. They are listed on figures 19, 21, and 35 and in table 33 as numbers 6, 7, 8, 9, and 10.

Fat Elk Drainage District. This area contains 2,284 acres lying south and east of Coquille. Many structures including pumps have been installed to help improve this acreage. Further improvements can be made in the same ways as in the Beaver Slough area. Two reservoir sites (numbers 14 and 15) on small side tributaries draining into this district have been studied.

Fish Trap Drainage District. This area near Arago is quite small containing only 251 acres. One reservoir site (number 16) was studied. There is more area that could conceivably be included in the same plan that includes at least one more reservoir site, number 17.

Iowa Slough and Norway Drainage Districts. These are two other organized small districts that bear some consideration. However, no reservoir sites were found that could materially affect the drainage and flooding problems.

Bear Creek. This area at about river mile nine on the Coquille River is near the upper limit of salt damage from tides. Two reservoir sites were studied, numbers 19 and 20. This creek area has good possibilities for channel work, irrigation, and flood control benefits.

Other Watersheds. There are undoubtedly other localities with similar problems and sufficient area to show enough benefits to offset the cost of project-type action.

Coos Subbasin

Subbasin 3, the Coos, includes all of the Coos River and tributaries and many short drainages along the coast north into Douglas County including

all of the area that drains into Tenmile Lake.

The subbasin was divided into 13 watersheds for the purpose of this study as shown on figures 19, 21, and 35 and in table 19C. Reconnaissance studies indicate that five of these watersheds have possibilities for improvement through P. L. 566. Some others would have been included in this group except many improvements have already been made by local people and government agencies, and the possible remaining benefits are greatly reduced.

The five watersheds selected are all of the same type with very little variation in problems and solutions. They are all sloughs that drain into Coos Bay with small streams running into them. All have had some improvements in the form of diking against tide action and the installation of tide gates. Those selected are listed and discussed below by name and number as shown on the maps and in the table.

Coalbank Slough, Watershed Number 2. This watershed is quite small with just over 4,000 acres. It flows north into the bay at the east edge of the city of Coos Bay. It includes 536 acres of land that floods from tide and streamflow water. It has been reported that plans have been made by local interests to ask permission to close the slough to navigation so that a dike and tide gate structure can be installed near the bay making it possible to eliminate several existing small tide gates and dikes along the banks of the slough. The slough then would become a storage area for the fresh water from the tributaries. The tide gate could be operated during the low rainfall season to store fresh water for irrigation. At present, there is no irrigation in the watershed, but the 536 acres of arable land is suitable for irrigation. No reservoir sites were studied in this drainage. Part of the land is not protected from tide water so the possibilities of land enhancement, improvements from flood protection, drainage, irrigation, and its close proximity to the city makes the possible benefit to cost ratio look favorable for a project. The Libby Drainage District operates in part of this watershed.

Haynes Inlet, Watershed Number 3. The 7,120 acres that is drained by Palouse Creek and Haynes Inlet is included in this watershed. The area that floods is organized into the Haynes Drainage District. The problems are the same as for Coalbank Slough except there may be an adequate supply of fresh water for irrigation. Palouse Creek has been diked at its outlet by the road fill and tide gates installed on the bridge. However, the improvements are not now in a state of good repair. One reservoir site was studied in this drainage; it is number 3 on figures 19 and 21 and in table 33.

Kentuck Slough, Watershed Number 5. This slough is the outlet for Kentuck Creek and Mettman Creek. It contains 10,920 acres of which 740 acres of the low land is in the Kentuck Drainage District. The problems and benefits appear to be similar to those for Haynes Inlet except that the tide gates seem to be in better repair and at a lower elevation. No reservoir sites were studied.

North Slough, Watershed Number 9. The North Slough Drainage District includes 300 acres of flooded land in an 8,190 acre watershed. The same problems exist here as in the Haynes Inlet and Kentuck Slough watersheds. Two reservoirs were studied, numbers 1 and 2. There may prove to be some bene-

fits for irrigation from such storage, but most benefits may be from flood protection. The water stored on the upper tributaries might take the place of storage near the tide gates. The present tide gate is at zero elevation, which is too high to give good flood and drainage relief. This area has one additional problem that can become quite serious. The tide gates are on the highway bridge and outlet into a long dredged channel that runs south parallel to the highway into the bay. The coastal sand dune areas is immediately west (windward) across a narrow shallow inlet. Blowing sands are a constant menace to the outlet channel, which, incidentally, is temporarily kept open by timber interests who use it to float log rafts from the receiving dump to a mill. Agriculture interests feel that this logging operation will soon be completed, which will leave the North Slough Drainage District with an extremely serious outlet problem.

Willanch Slough, Watershed Number 13. This watershed has an area of 5,000 acres. The Willanch Drainage District serves 200 acres of low lying cropland. The problems and benefits appear to be reasonable for the P. L. 566 program as they are comparable to the Haynes Inlet and Kentuck Slough watersheds. There are possibilities of a shortage of irrigation water, but no reservoir sites were studied in this drainage.

Chetco Subbasin

Subbasin 4, the Chetco, includes all of Curry County south of the Rogue River Basin. It was divided into six watersheds for this study (figs. 19 and 21 and table 19D).

The streams in this basin have a steeper gradient than those in the Coos and Coquille Subbasins. They are quite wild at flood stage causing much bank erosion and other damage. However, there is a very limited amount of cropland to be benefited both along the streams and the tide lands at the mouth. It is expected for this reason that it would prove very difficult to show a favorable benefit to cost ratio for any proposed plans under P. L. 566 in this subbasin.

One watershed, the harbor area, number 3, should be mentioned. It is a small area of 3,500 acres composed of several small creeks that flow directly into the Pacific Ocean. However, it is a bench and above tide action. The area is the major bulb and flower producing area in the basin. Some of it has already been subdivided for residence lots, and it appears that this trend to urbanization will continue. The major problems that need project-type action are water supply for irrigation and domestic use. The city of Brookings across the Chetco River to the north also is short of water. It is possible that one project could serve both areas. There is probably enough water in the Chetco River at the present time for both. One reservoir site was studied that could help solve this problem of supply. It is number 3 on Jack Creek (figs. 19 and 21 and table 33).

COORDINATION OF USDA PROGRAMS AND OTHER BASIN ACTIVITIES

In general, the forestry and agricultural aspects of water and related land resource problems are often intimately connected with uses of land and water for other purposes such as cities and towns, recreation, navigation, industry, and highways. The degree of relationship varies between geographic

areas depending primarily upon the resource base available and pressures upon that base.

The U. S. Department of Agriculture is concerned with all agricultural and forest land in the basin and is responsible for the administration of the 24 percent of the basin that is in national forests. The Bureau of Land Management of the U. S. Department of Interior is responsible for the administration of about 12 percent of the area. Therefore, the federal government is directly responsible for the administration of approximately 36 percent of the South Coast Drainage Basin. The management of this land is an important factor in the economy of the basin and influences the timing of waterflows and the quality of water flowing from the upper watersheds.

The Corps of Engineers, U. S. Army, under assignment by Congress is charged with the public civil works program to control, regulate, and improve river and harbor resources, to administer the laws pertaining to the preservation of navigable waters, and to plan, construct, and operate flood control works. Many of the existing and possible future projects under the Corp's jurisdiction affect agricultural lands. Substantial assistance in the solution of the basin agricultural problems has and will accrue from the coordination of the Corps' work and that of other interests in the basin.

Private and municipal water developments for power and industrial uses in some instances affect agricultural and forest lands. In many cases, substantial mutual benefits can result from the coordination of projects so as to solve or mitigate existing problems.

From an agricultural standpoint, there is a need for coordination of effort on present and future problems on an individual, group, and project basis. In turn it is important that agricultural water control and utilization developments recognize to the extent feasible all other land and water uses and values. Such coordination is necessary to secure a diminishment of mutual problems instead of their compoundment. Notable coordination has occurred and should be continued. This coordination ranges from informal contacts on individual problems to formal liaison between organizations and agencies on the inter-relationship of major projects.

Future small watershed projects need to be coordinated to insure the inclusion of all feasible features to enhance the use of both the watershed and its waters for all worthwhile purposes. In addition, small watershed projects need to complement other major water projects in the basin and make the best use of improvements provided under other programs.

It is hoped that the information in this report and the data gathered for its preparation will be of assistance to others in future coordination of the water and related land resources in the South Coast Drainage Basin.

MEANS TO HELP ACCOMPLISH NEEDED WORK - PROGRAMS OF USDA

Several agencies within the U. S. Department of Agriculture administer programs that are directly concerned with various aspects of water and related land resources. Many of the department's activities and programs are, or can be, helpful in the solution of problems and the accomplishment of needed work in the South Coast Drainage Basin. A short resume of pertinent

facts concerning them have been obtained from each of the USDA agencies most active in the water and land resource fields. These statements are contained in the following sections.

Agricultural Research Service

The Agricultural Research Service is the major scientific research agency of the U. S. Department of Agriculture. This service is charged with the responsibility for the conduct of fundamental and applied research in the physical, biological, engineering, and agricultural sciences. Research and regulatory activities are organizationally grouped into four major areas as follows:

1. The Utilization and Research Development activities are directed toward the discovery and development of new or improved uses for and methods of utilizing agricultural commodities of all types.

2. Farm Research is concerned with matters relating to farming practices and the production of agricultural commodities.

3. The Regulatory Programs are concerned with measures for preventing the introduction and controlling of the spread of animal and plant diseases and plant pests.

4. The Institute of Home Economics conducts research on matters relating to human nutrition, household economics, and clothing and housing.

Research needs to solve local soil and water conservation problems are submitted annually to ARS by the Cooperative Extension Service and Soil Conservation Service. These needs are organized by categories and priority, and research is initiated and carried out as funds and resources are available.

Agricultural Stabilization and Conservation Service

This agency of the U. S. Department of Agriculture administers at the state and county levels the Agricultural Conservation Program, Acreage Allotment and Marketing Quota Program, Price Support Programs, Soil Bank Program, Wheat Stabilization Program, Feed Grain Program, and other programs assigned to it by the Secretary of Agriculture or by the Congress. Of these, the Agricultural Conservation Program is the currently active program primarily concerned with conservation of soil and water resources.

The Agricultural Conservation Program is designed to provide a means of cost-sharing with farmers and ranchers a part of the cost of carrying out essential conservation practices. Cost-sharing is provided only on those practices that are satisfactorily performed.

Some of the practices for which cost-sharing is available in this basin are as follows: establishment of permanent protective cover for soil protection and improved soil structure, permeability or water-holding capacity; establishment of trees and timber stand improvement on farmland; improvement

of meadows; reseeding of rangeland; deferred grazing on rangeland; fencing of grazing land for protection of vegetative cover; control of competitive shrubs on rangeland; construction of tide gates and dikes; construction of erosion control structures; streambank and shore protection; open and closed drains; and irrigation ponds.

The Agricultural Conservation Program is tailored for local conditions by the ASC county committees, supervisors of the Curry County, Umpqua, and North Douglas Soil Conservation Districts, and cooperating agencies. The program is administered locally by elected Agricultural Stabilization and Conservation County and Community Farmer-Committeemen with the assistance, in technical matters, of the Soil Conservation Service, Forest Service, Cooperative Extension Service, and the State Board of Forestry.

The County ASC Committee in each county administers the Soil Bank Program, which helps farmers, during the terms of contracts entered into from 1956 through 1960 to adjust production to current market demands by retirement of cropland to conservation uses.

Farmers participating in the Wheat Stabilization and Feed Grain Programs are required to put into conservation use the acres taken out of these crops and to maintain the normal conservation acreage on the farm.

Cooperative Extension Service

The Cooperative Extension Service, which is made up of the Federal Extension Service, the State Extension Service, with additional financing from each of the several counties of the state, operates as one unit which is referred to as the "Cooperative Extension Service". This agency serves the USDA and the State Land-Grant Universities by accepting the responsibility for and leadership of the information and education activities within the South Coast Drainage Basin.

The Extension Service serves as liaison between research agencies, educational institutions, and local, federal, and state agencies, landowners and other individuals, to make available information and educational materials on improved crop varieties and livestock, land management use and practices, soil testing, home economics and family living including youth development, and other similar materials and, on request, works with individual landowners on specific problems relating to livestock, crops, horticulture, pest control, home economics, farm management and economics.

County agents in agriculture, home economics and 4-H work are located in nearly all counties of the United States. Within the South Coast Drainage Basin, county agents, with their respective staffs, are located at the county seat of each county in the basin.

These county agents take to the people the results of research and practical experience in subjects related to agriculture and home economics from all pertinent sources available, as well as information with respect to government programs directly affecting these people, whether administered by the U. S. Department of Agriculture, or by State and County Governments.

Extension agents take the lead in organizing counties for county pro-

gram making, in which the lay leaders, technicians, and administrative workers plan together to combine scientific information, local experience and government aids into local programs for the common good.

Cooperative State Experiment Station Service

The Cooperative State Experiment Station Service is the United States Department of Agriculture agency which is assigned the responsibility for administering the funds appropriated by Congress for research at the state agricultural experiment stations. This Service maintains a record of all state experiment station research projects, makes copies of this information available to all the states to eliminate duplication, and to aid in coordination of the state experiment station research with the Agricultural Research Service of the USDA. This office serves as the coordinating agency and information center for all the state experiment station research, both at the central experiment station of the state and at its several branch experiment stations.

Ordinarily the research findings of the state experiment stations are made available in the respective states to the public through the Cooperative Extension Service of the respective states. The research at the state stations includes both fundamental and applied research on animal and plant production and marketing problems, agricultural engineering, farm management and other economic problems relating to both production and marketing.

Branch experiment stations conduct research where problems can be more economically and effectively solved than at the central station. Problems affecting broader areas of the state are ordinarily included in the research projects at the central station at Corvallis.

Economic Research Service

The Economic Research Service administers research programs in relation to: (1) agricultural economics and statistics, (2) marketing analysis and development, (3) analysis of foreign trade policy, and (4) analysis of work conditions and developments affecting foreign markets for U. S. farm products.

Research on the economic aspects of land and water resources development and management is a responsibility of the Land and Water Branch of the Farm Economics Division. Major responsibilities in river basin investigations include:

1. Interpretation and appraisal of expanding requirements for agricultural production, changing production technology and depletion of the agricultural resource base and their combined implication for river basin development;

2. Analysis and projection of agricultural conditions and economic forces within designated basins or regions that influence the economic justification for agricultural resource development;

3. Development of a framework of projected needs and alternative sources and costs of production against which the

relative economic efficiency of water resource developments can be determined;

4. Economic analysis of agricultural water problems including drought, flood hazards, water shortages, impaired drainage, soil erosion, and inundation of agricultural land by water storage, water disposal and water conveyance facilities;

5. Development and use of economic data and analytical techniques for the design and evaluation of water control systems, and the development of comprehensive plans for resource use and development;

6. Participation in interagency efforts to achieve coordination of river basin programs, review of development plans and planning procedures, and maintenance of economic data on the agricultural impacts of river basin programs; and

7. Compilation and analysis of economic data, review and refinement of economic concepts, development of efficiency standards, and improvement of analytical techniques for benefit-cost analysis of river basin programs.

Farmers Home Administration

The Farmers Home Administration, through loans and other assistance, helps farmers place their operations on a more efficient basis. It also provides emergency loans for farmers who, because of drought, floods, or similar disasters, need a supplemental source of credit.

Credit extended by the agency supplements but does not compete with loans made by private and cooperative lenders. Veterans with farm experience receive preference for most types of loans. Most loans are made for the operation, purchase, and improvement of family-type farms.

Operation loans, that help farmers make better use of land and labor resources, are made for the purchase of equipment, feed, seed, fertilizer, livestock, and other farming needs including family subsistence. Loans are to be repaid in 1 to 7 years.

Farm ownership loans are made to help farmers buy land, improve land and buildings, and refinance debts. Loans are made from private capital and insured by the government or from appropriated funds. Loans are amortized for periods not to exceed 40 years but can be repaid in less time through larger payments in good years. Insured loans are limited to 90 percent of the fair and reasonable value of the farm.

Soil and water conservation loans are made on an insured loan basis or from appropriated funds. Borrowers may be individual farmers or nonprofit organizations serving farmers. Loan funds may be used to pay the cash costs of making improvements directly related to soil conservation; water development; conservation, or use; establishment of improved pastures; forestation, farm drainage; and related measures. Water development loans may also be made to provide water for rural communities of 2,500 or less population.

Individual loans are repayable in periods up to 20 years. Loans to organizations may be amortized over periods up to 40 years.

Watershed loans are made to help eligible organizations meet their share of the costs of works of improvement that protect, develop, and use water resources in small watersheds, and that are approved for operation by the Soil Conservation Service. Loans are to be repaid within the shortest time consistent with repayment ability, with a 50-year limit.

Rural housing loans are made to owners of nonfarm tracts in rural areas and rural communities with no more than 2,500 population. Loans may be made to construct, improve or repair homes and related facilities or farm service buildings or to provide water for farmstead and household use. The loans are repayable over periods up to 33 years.

Farm housing loans are made to owners of farms to construct and repair farm houses and other essential farm buildings. The loans are repayable over periods up to 33 years.

All loans are made through the agency's local offices serving all agricultural counties. Loans are subject to approval of applicant's eligibility by the Farmers Home Administration committee for the particular county. Each county committee is made up of three local persons, at least two of whom are farmers. The Farmers Home Administration supervisor in charge of the local office, which may serve more than one county, receive applications, make loans, assist borrowers with planning and carrying out farm and home plans, receive payments, and handle other phases of local program administration.

Forest Service

The primary Forest Service responsibilities are promotion of wise use and conservation of the nation's forest and related wildland resources. To meet this responsibility, the Forest Service carries on three main lines of work: (1) management of the national forests; (2) cooperation with the States and private landowners in obtaining better forest land management; and (3) forest and related range research.

Administration, protection, and management of the national forests of the South Coast Drainage Basin is divided among two national forests, each with a forest supervisor and technical staff. Supervisor's headquarters are at Grants Pass and Corvallis, Oreg. Each national forest is further divided into ranger districts, each of which is managed by a district ranger assisted by a technical staff. Ranger district headquarters are at Brookings, Cave Junction, Gardiner, Gold Beach, and Powers. The national forests are managed under principles of multiple use and sustained yield. This calls for obtaining maximum yield of the national forests' many renewable resources on a continuing basis to meet local and national needs without impairment of the long term productivity of the land. Though any one of the key resource values (wood, water, forage, wildlife, and recreation) may be of major importance on a given area, each receives equal emphasis in the overall management of the national forests. Most of these key uses are compatible, but when conflicts arise, they are decided on the basis of the greatest good for the greatest number of people in the long run.

Cooperation with the State and with private forest landowners is primarily through the Division of State and Private Forestry of the Pacific Northwest regional office in Portland, Oreg. The Division of Watershed Management of this office also furnishes technical assistance concerning watershed management work on forest land under Public Law 566. Many of the programs of these divisions are administered locally by the national forest offices mentioned previously. These cooperative programs emphasize: (1) protection of forest lands and critical watersheds against fire, insects, and disease; (2) promotion of better forest practices and returns from privately-owned forest land; (3) assistance in production and distribution of planting stock for forests, shelterbelts, woodlots; and (4) stimulation of development and proper management of state, county, and community forests.

Forest and range research in the basin is carried on by the Pacific Northwest Forest and Range Experiment Station, with headquarters at Portland, Oreg. A local research center of the station is located at Roseburg, Oreg. The experiment station and its research centers conduct research and surveys in the entire field of forestry and range management, regardless of ownership, including the growth, protection, and harvesting of timber, management of related range lands, protection and management of watersheds, efficient and economical utilization of forest products, and forest economics.

Rural Electrification Administration

The Rural Electrification Administration administers two loan programs: (1) for rural electrification facilities; and (2) for extension and improvement of rural telephone service. Loans for rural electrification are made to cooperatives, public utility districts, municipalities and power companies to finance electric generation, transmission, and distribution facilities in order to bring electricity to persons in rural areas not receiving central station electric service. The Rural Electrification Act provides that in making electric loans preference shall be given to cooperatives and other nonprofit organizations. It also authorizes loans to finance the wiring of rural establishments and the purchase of electrical equipment by those receiving service. R. E. A. loans have been made to finance electric and telephone service in the South Coast Drainage Basin through borrowers organized and operating under Oregon law. All loans are self-liquidating. Loans are made on a maximum 35 year amortization basis with interest at 2 percent.

The administration maintains no field offices. It has, however, a field staff of engineers, accountants, management advisors, and telephone specialists.

Soil Conservation Service

The Soil Conservation Service is the U. S. Department of Agriculture agency primarily assigned to the technical operations phase of soil and water conservation. Its principal duties are soil surveys, administration of the Watershed Protection and Flood Prevention Act (P. L. 566), technical assistance to local landowners through their self administered Soil Conservation Districts.

Most of the assistance provided to farmers for the conservation of soil and water resources in the South Coast Drainage Basin by the Soil Conservation

Service is through the Gold Beach, Reedsport, and Sutherlin Work Units serving the Curry County, Umpqua, and North Douglas Soil Conservation Districts respectively.

The technical assistance that is available to local landowners through the Soil Conservation Districts includes:

1. Soil surveys that provide an inventory of soil resources and vegetative inventories. They show the capability of land and serve as a guide to planning needed conservation practices.

2. Assistance to individual landowners to develop Conservation Farm and Ranch Plans that delineate the particular needs on their own land and outline an action program for the conservation of soil and water that is tailored to their operations and resources.

3. Technical assistance in planning and applying conservation practices in the fields of: engineering, agronomy, geology, woodland, range, soils, hydrology, biology, plant materials, and water forecasting. This involves such conservation practices as conservation cropping systems, crop residue use, pasture improvement and management, range improvement and management, pond construction, woodland protection and management, waterway development, farm drainage including tile and open ditch, land grading and smoothing, irrigation system design, proper irrigation water use and similar practices.

4. Helping groups of landowners to plan and apply drainage and irrigation measures that cover more than one ownership.

5. Assist local organizations to develop and apply Work Plans under the Watershed Protection and Flood Prevention Act (P. L. 566) for the overall solution of flood and water management problems on watersheds of less than 250,000 acres.

The Soil Conservation Service provides technical assistance to the Agricultural Conservation Program on permanent type conservation practices. Needs and feasibility are determined, designs and layouts are made, and completed practices are checked for compliance to technical standards.

In addition, the Service provides technical information and consultation to private engineers, architects, and others (agencies, organizations, and individuals) who need help on specific soil and water conservation problems.